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## SPECIAL IUCN ISSUE

Volume 6 ■ Number 2 ■ Fall 1996

OCT 7 1996

# Global biodiversity

An International Forum on the Variety of Life on Earth...
research, conservation and wise use

Forest Biodiversity
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Economic incentives
■
E.O. Wilson, Calestous Juma, and more

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## Editor's Notebook

### PATENTING HUMAN GENES

There is debate in global and state arenas about whether human genes, including genes of indigenous peoples, should be patented. Patents have been issued in the United States on genes of indigenous peoples. The European Union recently decided not to accord patents on human genetic resources. At Jakarta, the Conference of the Parties of the Biodiversity Convention (COP-2) decided, at least for the moment, that it would not include human genetic resources in its deliberations. On the other side, some private and public sectors are moving ahead at full speed with the patenting and exploitation of human genes.

The International Convention on Biodiversity is all-encompassing, covering conservation of biodiversity, sustainable use of its components, and fair and equitable sharing of the benefits arising out of the use of genetic resources. This definition of biodiversity is "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." This clearly includes human genes, and the wording "from all sources" emphasizes its inclusiveness. Similarly the definition of genetic resources is inclusive and does not exclude human genes; "'Genetic resources' means genetic material of actual or potential value." Nor are other articles of the Convention any less inclusive.

There is no doubt that the question of patenting human genes touches on several sensitive issues: the membership of humans in the family of life and its relationship to religious beliefs, the feeling of vulnerability of indigenous peoples, and the wish to achieve material benefits while securing intellectual property protection — without the concomitant sharing of benefits warranted under the Convention. Since something like 95% of human genes are in other organisms, the transnational gene tech companies could escape obligations of the convention if this escape hatch is provided.

But ignoring the problem will not make it go away. The study of human genes can yield procedures that would save thousands of human lives. Indigenous peoples deserve full acceptance, a sharing of benefits, protection from cultural and biological extinction, even while their genes are preserved in banks.

A world organization should be considering these profound questions. That organization should be globally representative, have regular and open procedures for discussion, and be underlain by an agreement that will promote fair and equitable solutions. An organization that focuses on a narrow spectrum of issues and expertise would not be appropriate for such a broad and profound question.

In my view, the next Conference of the Parties of the Convention on Biological Diversity should return to its agenda the responsibility for a full and open discussion of the options for dealing with human genetics. If the Conference of the Parties does not deal with it soon, the issue will be settled *de facto* by the private sector in the North.

Don E. McAllister

Don E. McAllister
Editor

## The goals of Global biodiversity are to:

- *Publish articles, views, and news on biodiversity*
- *Bridge the gaps between professional disciplines & the public*
- *Communicate vital information to help humankind make decisions on the fate of the Earth's life*
- *Express views on the needs & value of biodiversity research*
- *Provide an international forum for discussing issues on biodiversity*
- *Enhance awareness of the role of biosystematic research & museum collections in conservation & ecologically sustainable use of biodiversity*
- *Discuss methods and philosophy of biodiversity conservation*
- *Review books and periodicals on biodiversity*

***Global biodiversity*** **is printed on recycled paper using vegetable oil ink; cover stock contains 100% post-consumer waste and text stock contains 30% post-consumer waste.**

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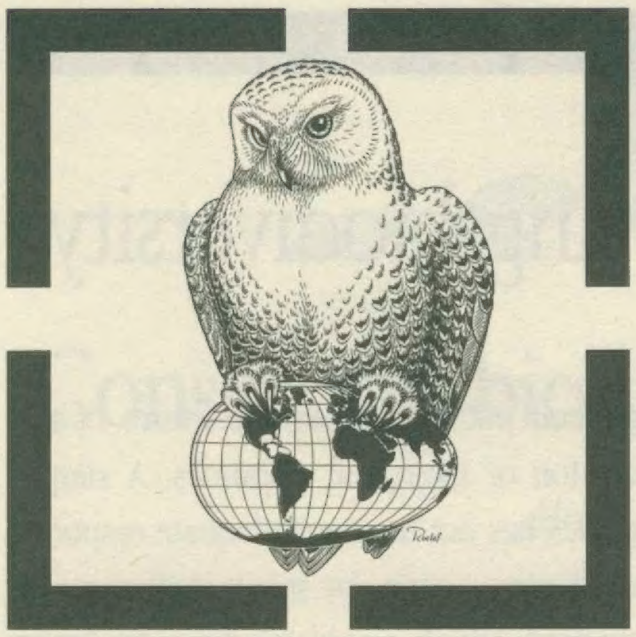
# Global biodiversity

Volume 6, Number 2, Fall 1996



The Snowy Owl was chosen as the symbol for the IUCN's World Conservation Congress being held in Montreal in October 1996. The Department of Canadian Heritage/Parks Canada and the IUCN have established the theme of the Congress as "Caring for the Earth."

*Editor:*
DON E. McALLISTER, Ph.D.

*Associate Editors:*
ALEJANDRO ARGUMEDO, Cultural Survival Canada
PAUL CHABEDA, United Nations Environment Program
MAXIMO T. KALAW, JR., Haribon Foundation, Manila
ELIZABETH MAY, LL.D., Sierra Club of Canada
JACQUES PRESCOTT, Environnement et Faune, Quebec
IAN SMITH, Ph.D., Agriculture and Agri-Food Canada

*Book Review Editor:*
PATRICK COLGAN, Ph.D.

*Managing Editor:* CATHERINE RIPLEY
*Assistant Editor:* LEANNE RIDGEWAY
*Technical Editor:* NOEL ALFONSO
*Illustrator:* ROELOF IDEMA

*Graphic Design & Production:*
NICOLE DUPUIS

**News, views, articles for publication and books or papers for review should be sent to:**

*Catherine Ripley, Managing Editor*
Global biodiversity
*Canadian Museum of Nature*
*P.O. Box 3443, Station D*
*Ottawa, Ontario K1P 6P4, CANADA*
*Fax: (613) 566-4763*
*E-mail:* **<cripley@mus-nature.ca>**

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**Persons wishing to subscribe, place ads, or support the publication financially should contact:**
*Business Manager:* DAWN ARNOLD
*Subscription Manager:* SUSAN SWAN (613) 566-4784
*Fax:* (613) 566-4763
*E-mail:* **<darnold@mus-nature.ca>**

*Global biodiversity* is published quarterly. Annual subscription rates are $26.75 for individuals and $53.50 for institutions in Canada; $25 U.S. for individuals and $50 U.S. for institutions in United States and other developed countries; and $10 U.S. for individuals and $15 U.S. for institutions in developing countries. Claims for missed issues will be honoured up to six months after the missed issue within Canada, and up to one year outside Canada.

Version française disponible :
*La biodiversité mondiale*
ISSN 1195-3101 (English edition)
ISSN 1195-311X (édition française)

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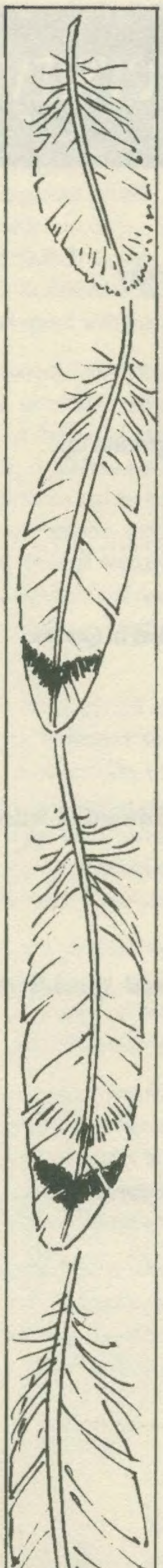
GUEST EDITORIAL

# Responsibility for conserving biodiversity

*Global biodiversity* is delighted to welcome Dr. Jeffrey A. McNeely as special guest editor for our "IUCN and Biodiversity" issue. We thank him and all of the IUCN contributors for their cooperation and imagination in suggesting a rich and thought-provoking issue. We welcome your comments.



Over the past several decades, the general public has become aware of the increasing problems caused by the erosion of biological resources. A simple focus on deforestation or individual species has not been an adequate response to the problem, despite concerted and effective actions by many institutions. A more comprehensive approach was required, which would involve a far larger set of related interests to address conservation and bring information, knowledge, awareness, and ethics together with protected areas, agriculture, economics, intellectual property rights, land tenure, trade, forestry, and so forth.

This broad approach was given the label of "biodiversity," though a more precise and narrow definition of biodiversity is "the measure of the world's variability of genes, species, and ecosystems." To this definition it is important to add the variability of the functions or services provided by species for the world. To complicate the picture slightly, a political definition has come from the Convention on Biological Diversity (CBD): "the variability among living organisms from all sources, including inter alia, terrestrial, marine and other aquatic systems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems." The tangible manifestations of biodiversity are biological resources, defined as any biotic component of ecosystems with actual or potential use for humanity.

Conserving biodiversity, using biological resources sustainably, and ensuring that benefits arising from the use of biological resources are shared equitably have become issues of major international and political concern over the past decade. The most important global initiative has been the CBD. It is one of the most important results of the Earth Summit and it has already been ratified by nearly 150 governments, the fastest rate of adherence to any international convention. Reflecting growing political will to address the competing demands for biological resources, the CBD provides a framework within which each government can decide for itself how best to conserve its own biodiversity. The great enthusiasm that the CBD has generated among governments and the scientific community shows that it is an entirely viable proposition. It is bringing governments together at a senior level to discuss issues of vital importance to all countries. Even governments that have not yet ratified the CBD will be inevitably influenced by decisions made by the Conference of the Parties.

This special issue of Global biodiversity celebrates the 20th General Assembly of the IUCN, now called the World Conservation Congress (WCC), being held in Montreal during October. The articles contained herein show how the CBD's objectives are being implemented in different parts of the world. Many other examples will be discussed at the WCC, demonstrating that conservation is still alive and well — despite worrying economic conditions in many parts of the world. But of course, this is not the time for complacency, as the forces of exploitation and consumerism are also gaining strength. Those interested in conserving biodiversity for the benefit of future generations will need to redouble their efforts in the coming years if the ideals of the CBD and the IUCN are to be realized.

Jeffrey A. McNeely, Chief Scientist,
IUCN — The World Conservation Union, IUCN Headquarters
rue Mauverney 28, 1196 Gland, Switzerland
Tel: 4122-999-0001; Fax: 4122-990-0025; E-mail: <jam@hq. iucn.org>

# Conserving biodiversity — From the ground up

*Alison Wilson, IUCN Biodiversity Programme*

*IUCN makes an immense contribution to global and local conservation of biodiversity. Its power is due to its dedication to linking individuals, small groups, organizations, and governments in a cooperative effort. Perhaps no better way of appreciating the extent of IUCN's reach is to provide a series of vignettes of IUCN projects around the world, as Alison Wilson does below. [D.E.M.]*

Four years after the Earth Summit, efforts to conserve the Earth's natural resources are taking on new momentum. Through its network of over 8,000 experts and its partnerships with more than 800 member organizations in 132 countries, IUCN — The World Conservation Union, is in a strong position to make a substantial contribution to the conservation and sustainable use of biological resources.

This contribution is taking place in the context of radical changes in the whole philosophy and practice of global conservation. In the past, for example, efforts to conserve biodiversity focused largely on preserving enough large habitats in a state of minimal human disturbance. While this approach is still valid, the number and size of protected areas is probably reaching its upper limit in most countries, at least in terrestrial ecosystems. However, 90% of the Earth's land area, and most of its biodiversity, still lies outside protected areas, and over 99% of the ocean and interconnected seas are unprotected. This natural wealth is utilized, in varying degrees, by the greater part of humanity on a daily basis both directly, as biological resources, and indirectly, as ecological services. Experience has shown that linking conservation activity at the local (community) level with national conservation strategies is vital. The bottom line is that effective, long-term conservation of biodiversity can be greatly assisted by "putting people first." This means listening to their concerns, encouraging their ability to organize themselves, and then addressing their needs by improving access to, and ownership of, natural resources. The old cliché "think globally, act locally" has never rung so true.

With literally hundreds of conservation projects — more than 300 in 130 countries — being undertaken around the world, it is difficult to choose just a few as illustrative examples. However, here is an overview of some of the activities that IUCN's members and partners are undertaking to conserve biodiversity — from the ground up.

## ACTION AT THE GRASS ROOTS LEVEL

Actions taken at the community level are becoming the keystone of global efforts to conserve biodiversity. The impact and effectiveness of such actions hinge on partnerships between local communities and NGOs, in cooperation with government ministries.

### Central and South America

Funding for such actions is sometimes generated locally but often comes from bilateral or multilateral aid agencies as well as NGOs. Such synergy is illustrated by a project in Costa Rica, where IUCN's Wetlands Programme is working with the Agronomy Centre for Research and Training (CATIE) to train and strengthen local groups to manage and use their coastal resources sustainably. Here, extraction, shrimp aquaculture, and runoff of pollutants from inland farms threatens the Térraba-Sierpe mangrove ecosystem that contains 40% of the country's mangroves. The most serious threat comes from entrepreneurs who have recently moved to coastal areas, but the local communities also pose a threat to the mangrove forests. Local peoples have long used the mangroves for a variety of products including fuelwood, bark, and fish and

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*Alison Wilson, IUCN World Headquarters, rue Mauverney 28, CH-1196 Gland, Switzerland; Tel: ++4122-999 00 01; Fax: ++4122-999 00 02; E-mail: <mail@hq.iucn.org>*

shellfish. More often than not, local people were only using part of the trees. By getting them to use the whole tree, their pressure on this natural resource was greatly reduced. To minimize the effects of local threats, and with funding from the Danish Development Agency DANIDA, the project's partners have provided technical assistance to a locally formed cooperative, which has developed improved charcoal furnaces, efficient bread ovens that can be used by local women, and a successful marketing strategy for natural resources harvested from the mangroves. In cooperation with the Ministry of Education, a number of environmental education materials have been distributed. Most important, there has been widespread community participation in developing a long-term management plan for the Térraba-Sierpe mangroves.

Further south, in Colombia, the Foundation for Sierra Nevada de Santa Marta has been active for many years in promoting conservation in the world's highest coastal mountain range. A Pleistocene refuge, the Sierra Nevada de Santa Marta has many endemic species and a great diversity of habitat types. The Foundation is working with local people, including four indigenous groups, to resolve conflicts, develop sustainable ways of using resources, and formulate a conservation strategy for this politically complex and often socially unstable region.

Ron palm, *Borassus aethiopum*, showing the male flower cluster, the female fruit cluster, and the millet normally planted below — integrated agriculture with multiple products: wood, nuts, and grains.

**Africa**

In Africa, a number of community-based actions are being undertaken in a wide variety of ecosystems. In eastern Africa, human populations have increased at unprecedented rates during the past few decades and the need for conserving natural resources and finding ways to use them in a sustainable manner has never been greater. One example of conservation-in-action is the Mount Elgon Conservation and Development Project in eastern Uganda. Here, the slopes of Mount Elgon, once covered by extensive forests, are home to more than 220,000 people. In 1940, a Forest Park was established to preserve the remnants of the forest ecosystems. However by 1988, when the Mount Elgon Conservation and Development Project began, agricultural encroachment, illegal pitsawing, and livestock grazing had degraded or destroyed over a third of the montane forest. The project aims at conserving the biological diversity and ecological processes of the forest while ensuring that local communities can still derive economic benefits from the surrounding land — an enormous challenge, requiring well thought-out extension and education activities in local villages. The project team is conducting biodiversity surveys of the park, identifying the resources local peoples are extracting from it, and developing plans to manage the Park in collaboration with villagers.

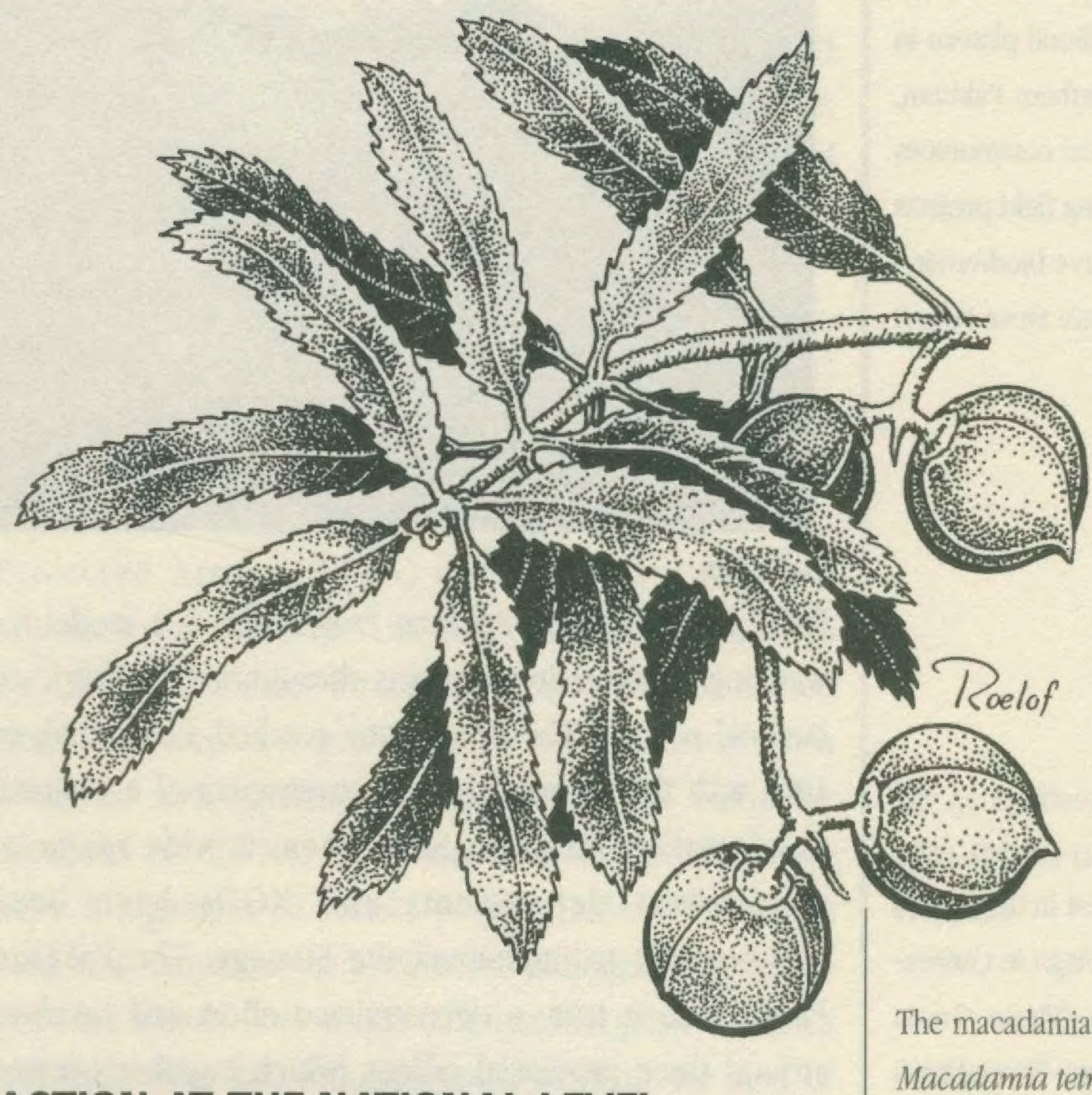
Another example of supporting local peoples in the sustainable use of their resources is the Collaborative Forest Management Initiative in Western Africa. Much of West Africa lies within the Saharan and Sahelian zones where nomadic pastoralism is the order of the day and opportunities for agriculture are limited. Local communities in the southern region of Gaya in Niger have enthusiastically embraced a program to conserve and manage their natural resources. The focus of this project is the ron palm, *Borassus aethiopum*, which provides them with construction material and fibre for baskets. In fact, every part of the palm has a use. Millet is planted between the palms, and animals are brought in to graze after the harvest. All the partners working in Gaya — the Government, IUCN and the Swiss Development Agency — are in agreement that management of natural resources should devolve to the village level, and the key question in Gaya revolves around ownership. In this sense, it is a classic sustainable use project, but it is also a model for decentralized use of natural resources.

Yet another example is the Waza National Park in Central Africa. This region is rich in natural resources, with extensive rainforests, savannas, and wetlands. The 500,000-hectare Waza-Logone floodplain in northern Cameroon once provided local communities with fish and seasonal pasturage. But when the upstream Maga reservoir was built to provide water for rice irrigation, this valuable wetland, rich in flora and fauna, dried up for 15 years. To put it mildly, this "after effect" adversely affected the biodiversity of the region as well as the people who live there. The Cameroon Government, the Netherlands Ministry of Development Cooperation, volunteers from the Netherlands Development Organisation, and WWF-Netherlands, are now working to restore the floodplain's ecological processes with seasonal releases of water from the dam. So far, two such releases have occurred and have been a great success: perennial grasses are returning to the floodplain and fishing activities have resumed. In fact, the project has had a great impact on the lives of local people — marriage ceremonies are starting to take place for the first time since the dam was built. Following consultation with the local people, a much bigger release of water — 10 billion cubic metres — is planned for 1997.

**South Pacific**

Besides providing timber, forests harbour a cornucopia of products including herbal medicines, edible fruits and nuts, honey, weaving fibres, and many other items. The use of these non-timber forest products (NTFPs) by indigenous peoples is widespread. When forests are strictly protected, local peoples may be denied entry — equivalent to shutting down the only supermarket in town. Yet extracting NTFPs could be sustainable, if properly managed. In the Palawan Islands of the southwest Philippines, local NGOs are conducting a study of the use of NTFPs in the buffer zone of the St. Paul National Park, a world heritage site. The project, funded by the European Union, will develop a plan for sustainable use of the forest and its products, which include rattans and tree resin.

In the Arnavon Islands, a group of small atolls that form part of the Solomon Islands, the focus of sustainably using natural resources is on coral reefs. Here, local communities rely on the reef's bounty for subsistence. In addition, the reefs are also home to commercially valuable species such as sea cucumbers, giant clams, pearl oysters, and green snails that bring in much-needed income. A rapid ecological assessment of the reef ecosystems has indicated that many species are being overexploited. While part of the area has been identified by the Solomon Islands' government as a proposed Marine Protected Area to preserve the amazing diversity of marine life found therein, The Nature Conservancy, local communities, provincial and national governments, and the South Pacific Regional Environmental Programme have been working together to foster more sustainable use of all of the Islands' marine resources and to promote stricter conservation of the endangered Hawksbill turtle. A management plan has been drawn up by all the partners and includes a three-year ban on the harvesting of commercially valuable resources, complete protection for the Hawksbill turtle, and an education and enforcement program. The recovery of over-harvested species included in the fishery ban will be monitored and after the ban has been lifted, sustainable harvest quotas will be implemented. In August 1995, villagers and provincial and national governments declared the area as the Arnavon Islands Community-Managed Conservation Area, the first of its kind in the South Pacific.



The macadamia nut, *Macadamia tetraphylla.* Originating in Irian Jaya, Indonesia, this nut tree has been planted worldwide for its extremely valuable nuts and fine wood.

## ACTION AT THE NATIONAL LEVEL

Implementation of the Convention on Biological Diversity (CBD) has opened up many new opportunities for international cooperation at global and regional levels, but inevitably the greatest number of conservation activities, and the most effective action, take place in a national context. At this level, IUCN is providing technical advice for countries to meet their obligations under the Convention. For example, IUCN is assisting the development of National Biodiversity Strategies and Action Plans, monitoring actions that have negative effects on biodiversity by helping to strengthen legislation, and helping to establish networks of protected areas.

Ensuring that national biodiversity strategies and action plans, called for by Article 6 of the CBD, are undertaken and implemented effectively is a many-faceted process. All sectors of society are, or should be, involved from the political and business establishment right down to the local community level. In fact, participation by those who have the biggest investment in conserving natural resources — indigenous people, women, and other "minority" groups — is vital for success. National strategies for environmental education are also important and are being designed in several countries that to date have not had such concerns built into formal or informal curricula. Croatia, Poland, Nepal, and Zambia are a few of the countries embarking on this process.

An agricultural plateau in Northern Pakistan, where local communities are running field projects to conserve biodiversity. (Photo: Steve Fuller)

**Pakistan**

IUCN's wide-ranging Pakistan Programme is a model for weaving biodiversity concerns throughout the fabric of national society. The Programme reached a landmark in 1992 with the approval by the government of a National Conservation Strategy. Since then, a wide range of government departments and NGOs have been collaborating to implement the Strategy. The Pakistan Programme is truly a decentralized effort and revolves around three provincial offices, which together oversee literally dozens of projects ranging from institutional capacity building, to raising environmental awareness, to creating economic and legal incentives for conserving biodiversity, to a variety of "hands-on" field projects that involve local communities. In 1994, a Provincial Conservation Strategy for the northwest province of Sarhad was launched.

**Uganda**

Stanley Okrut, the head of a local NGO that is deeply involved in the implementation of Uganda's National Wetland Conservation Program. (Photo: Grazia Borrini-Feyerabend)

In 1994, Uganda became the second country (Canada was the first) to adopt a National Wetlands Policy. This policy is aimed at the wise use and management of the country's many wetlands that range from the papyrus-fringed inlets of Lake Victoria to the lakes of the western Rift Valley. Uganda's aquatic resources play an important role in Uganda's rural and national economy providing a number of fish species for food purposes and for export as ornamental fishes, a variety of building and thatching materials, and water for irrigation. Uganda's National Wetland Conservation and Management Programme (NWCMP), which is under the Ministry of Natural Resources, played a central role in developing the wetland policy. NWCMP's Paul Mafabi sums up:

> One of the main lessons we learned in the policy development process [was] the need for inter-sectoral linkages. Wetlands mean different things to different people, and use by any one interest group should not limit, curtail, or deny the use by other groups.... The formulation of the policy has been challenging, generating a great deal of awareness within government of the importance of wetlands and the need for collaboration.

**Guinea-Bissau**

In the West African state of Guinea-Bissau, the National Environment Council (a consortium of eight government ministries) is formulating a National Strategy for Sustainable Development. The implementation of this Strategy will include strengthening environmental legislation and improving management of coastal mangrove ecosystems and fisheries. A scheme to give local fishers exclusive rights over their marine resources and the opportunity to impose fees for outsider fisheries is being developed. New coastal protected areas are being established, including a proposed Biosphere Reserve in the Bijagos Archipelago. A "debt-for-nature" swap, brokered by IUCN and agreed upon by the Guinea-Bissau and Swiss governments, has freed local funds for improving the capacity of local environmental NGOs to address biodiversity conservation issues.

Forest in the Bijaros Archipelago in Guinea-Bissau. (Photo: Grazia Borrini-Feyerabend)

**Vietnam**

In 1993, a series of surveys were undertaken in Vietnam to take an inventory of marine and wetland resources, land status, and human impacts. This process led to a national Biodiversity Action Plan that has become the government blueprint for conservation. A number of NGOs and government ministries have begun implementing Vietnam's National Conservation Strategy by setting up marine protected areas, initiating technology transfer, and encouraging community management of natural resources, including processing and marketing NTFPs. In a nutshell, they have been putting a "green" slant on the whole process of *doi moi*, or economic reform.

## REGIONAL ACTIONS

Addressing conservation needs from a regional perspective is emerging as an effective approach. Apart from the fact that environmental mismanagement in one country can have far-reaching consequences for its neighbours, ecosystems (and many species) do not respect national boundaries. IUCN's increasing emphasis on regional approaches is paying dividends in this regard. Regional biodiversity forums, which bring governments and NGOs together to share experiences, will encourage international cooperation to formulate joint strategies for action.

Life on the Danube delta. (Photo: Liz Hopkins)

### Focus on rivers

Nowhere is the need for the regional approach more obvious than in the conservation of river systems. Europe's Danube River and its tributaries pass through 14 countries on the way from its headwaters to the delta on the Black Sea. Wastes from cities and industries are discharged into the river, and agricultural runoff is also a huge problem. In 1994, the Danube Basin countries and the European Union signed a Convention on Cooperation for the Protection and Sustainable Use of the River Danube. Chaired by the European Union, the Task Force for the Danube Basin Environment Programme, which includes riparian country governments, international financing institutions, an NGO coalition, and IUCN, produced a Strategic Action Plan. IUCN was asked to provide a synthesis and analysis of national reports on behalf of the Task Force and, working with WWF, succeeded in ensuring that wetland protection and rehabilitation were included as a priority in the Action Plan.

In Southern Africa, four wetlands in the Zambezi River Basin are the focus of a major conservation agreement between the Canadian International Development Agency (CIDA), IUCN, and the four governments involved. The wetlands are situated in Zambia, Namibia, Malawi, and Mozambique. The project will help local communities living near these wetlands to manage their resources, improve flood control, and strengthen health and education services.

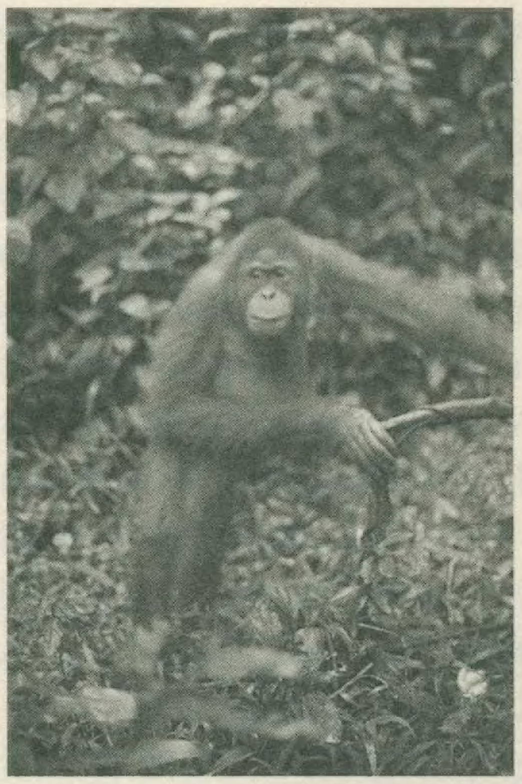
### Focus on protected areas

Europe's protected areas, although extensive, differ greatly from one country to another both in nature and in the type and quality of management they receive. In 1992, IUCN's Commission for National Parks and Protected Areas (CNPPA) decided that a regional approach was called for. Like many other projects, Parks for Life — Action for Protected Areas in Europe started small but kept on growing. In collaboration with protected area agencies and assisted by the volunteer members of CNPPA, an action plan was produced in 1994. It highlights 30 priority projects. Although the plan puts most emphasis on work at the national level, it also provides a basis from which different European countries can learn from and influence each other in the area of protected area management. Such regional cooperation is already underway in some areas: in northern Europe, for example, officials from several National Parks in Lithuania, Latvia, and Estonia have formed the Association of Baltic National Parks in order to exchange information, raise public awareness, and use their joint expertise for training of parks personnel. On a national level, Poland's National Parks Unit, part of a national NGO that boasts several CNPPA members, is following up on Parks for Life by supporting action to create new protected areas, enlarge existing ones, improve the legal basis for nature conservation, and ensure that communities surrounding protected areas share the benefits.

Wetlands can also be regional in nature. Here, fishers are seen in the inner delta of the Niger River in Mali, where IUCN is implementing a regional wetlands program.

### Politicians for biodiversity

A remarkable initiative called the Central American Alliance for Sustainable Development was launched in 1993 by US Vice-President Al Gore and the presidents of seven Central American countries. One of its aims is to improve the quality of life for all peoples of MesoAmerica by conserving the region's rich biodiversity. This process builds on initiatives already underway in forest management, sustainable agriculture, and protected area development. It also provides a framework for future regional cooperation. The Central American Commission on Environment and Development plans to undertake a number of projects on ecosystem conservation, sustainable use of wildlife, environment legislation, climate change issues and the prevention and combat of forest fires.


Orangutan in Sumatra, one of the species receiving attention from IUCN's Species Survival Commission. (Photo: Jeffrey A. McNeely)

## IUCN AT THE GLOBAL LEVEL

IUCN's global activities are as diverse as the biodiversity it aims to protect. One such activity is the promotion of the CBD as a potent tool for conservation. Another involves cooperation with the Global Environment Facility (GEF), now a major source of conservation funding worldwide, to improve the design and implementation of GEF projects. Yet another initiative is seen in the IUCN's Biodiversity Programme and Environmental Law Centre. Here collaboration produced the *Guide to the Convention on Biological Diversity* in 1994, which has since been translated into French, Spanish, Korean, and Arabic.

IUCN also acts as a lobbyist — often behind the scenes at meetings focused on biodiversity matters. For instance, at the 1994 Conference of the Parties to the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) in Fort Lauderdale, Florida, IUCN successfully mobilized the enormous expertise of its professional networks to lobby for the tightening of controls on trade of a number of threatened species.

Finally IUCN is responsible for "Conservation's best-kept secret" — the Species Survival Commission. This body, aimed at saving the cogs and wheels of biodiversity, is no secret to the 7,000 or so experts who volunteer their time and knowledge to make it an effective tool for species conservation. The Commission's members are organized into over 100 specialist groups, each of which covers a group of plants or animals — tortoises, palms, cacti, or canids, for example. There are also six interdisciplinary groups, which cover such subjects as reintroductions, invasive species, conservation breeding, and sustainable use. One task undertaken by each taxon group is to develop an action plan for threatened species coming under its purview. Ten years after the first action plan was produced, it is clear that these are far from paper exercises — many of the recommendations for conservation action are indeed taken up when funding becomes available. The specialist groups have recently been undertaking the complete revision of the *IUCN Red List of Threatened Animals*, applying new criteria to evaluate the conservation status of their respective taxa. The revised *Red List* will be appearing later this year and will be available at the Congress in Montreal in October. Readers may also write to IUCN Headquarters for a copy (at the address on page 3).

In the field of threatened species management, the reintroduction of extirpated flora and fauna into their natural habitats, now practiced in a growing number of countries, has attracted attention from the media. The specialist group dealing with reintroduction has just completed the *Guidelines for Reintroductions*, which outline considerations that should be taken into account by agencies returning species to the wild. These include ensuring that the genetic provenance of the species to be reintroduced is appropriate for the site where it is being released, that the reasons for the original extirpation have been addressed, and that stringent pre- and post-release procedures are observed.

## CONCLUSION

Conserving biodiversity requires action at all levels, from the individual farm or protected area up to the bioregion, the nation, and the entire globe. IUCN is working at all of these levels, seeking to apply the lessons learned on the ground to policies that are relevant at the global level.

# Incentives for biodiversity

*Frank Vorhies, IUCN Biodiversity Programme*

*Action and inaction by governments result in incentives that work for or against biodiversity. Policies to promote increasing the area of farmland may result in shrinkage of forests; mariculture of shrimps may devastate mangrove areas; loan guarantees for construction of fishing vessels may lead to fishing overcapacity. Frank Vorhies helps us to understand incentives, how to identify their effects on biodiversity, and what to do about them, as well as how to create incentives that will foster biodiversity. [D.E.M.]*

## INTRODUCTION

The momentum is building — more than 140 countries have now ratified the Convention on Biological Diversity (CBD), two meetings of the Conference of the Parties (COP) to the Convention have occurred, a Secretariat has been established — the CBD process is truly moving rapidly into its implementation phase. Part of the implementation process will — and must — include incentive measures. Sometimes called economic instruments, incentive measures incite, induce, or motivate desired behaviour, in this case with respect to the conservation and sustainable use of biological resources. Implementing these measures, under Article 11 of the CBD, is up for discussion at COP-3 in November 1996. There is also a real possibility of incentives becoming a permanent item on the agenda of the COP. Article 11 states: "Each Contracting Party shall, as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity."

There is a vast array of possible incentive measures. These include ownership and use rights, tradable resource shares, tradable development rights, pollution taxes, royalties and resource taxes, impact fees, access fees, financial subsidies and soft loans, environmental funds, resource damage liability, environmental performance bonds, land reclamation bonds, and deposit refund schemes. Furthermore, these measures can be applied at various levels — local/municipal, district/provincial, national, transboundary/regional, and international. They, of course, could also be designed to promote the equitable sharing of the benefits from the use of biological resources.

## IDENTIFYING APPROPRIATE INCENTIVES

The first step in determining which incentive measures are appropriate for which situations is to assess the underlying causes of the loss of biodiversity. Biodiversity loss assessment, like environmental impact assessment, is concerned with the environmental or ecological impact of projects, programs, and policies. While environmental impact assessments look forward and try to assess what the future impact is likely to be, biodiversity loss assessments start with an observation of the impact in the present — the loss of or threat to biodiversity — and then look backwards to assess what has brought about the current situation.

Both types of assessment then propose mitigating measures to improve matters. With environmental impact assessments, however, the mitigating measures can be implemented before the project and program begins. This allows features or aspects of the activity under consideration to be altered to reduce their impact on the environment. In contrast, with biodiversity loss assessments, the activities are already in place. Thus the mitigating incentive measures must take into account established and often well-entrenched cultural, social, economic, and political relationships.

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*Frank Vorhies, Economist, IUCN Biodiversity Programme, IUCN Headquarters, rue Mauverney 28, 1196 Gland, Switzerland; Tel: 4122-999-0001; Fax: 4122-999-0025; E-mail: <fvv@hq.iucn.org>*

"Perverse incentives" are one example of measures that are part and parcel of a complex, entrenched relationship that then become pinpointed as detrimental to biodiversity after a biodiversity loss assessment has taken place. This type of incentive aims to induce a desired behaviour in one respect, but at the same time, it unintentionally induces behaviour that leads to a reduction in biological diversity. A classic example is the complex package of direct and indirect subsidies to agriculture to promote a food security objective. While successful in achieving the food security goals, these same subsidies provide perverse incentives to destroy savanna, wetland, marine, and forest ecosystems.

Once a biodiversity loss assessment has identified the underlying causes of the loss, such as a perverse subsidy, the challenge is to identify incentive measures that will be culturally, socially, economically, politically, and biologically acceptable, to induce behaviour that promotes the conservation and sustainable use of biological resources. Selecting and implementing these sound incentive measures requires a combination of skills and perspectives. It requires scientific understanding — ecological and economic — as well as cultural sensitivity and political astuteness. As you can see, it is no easy matter.

## INCENTIVES IN ACTION

Nevertheless, throughout the world, many sound measures are already in place. In Bulgaria, a country in economic transition, local municipalities charge beach tourists directly to finance beach conservation activities. In Zimbabwe, rural communities with use rights to wildlife sell consumptive and non-consumptive access rights and thus make money through sustainable use. In the Philippines, a national environmental fund has been set up through a series of "debt-for-nature" swaps. At the provincial level in Brazil, an environmental sales tax is charged on the sale of goods and services to finance the conservation of the forested watershed. And in the US, governments allow tax deductions for contributions to not-for-profit conservation organizations, such as IUCN and WWF. Still another example is a tax deduction to land owners who use part of their land to benefit wildlife.

## STEPS TO BE TAKEN

At this stage in the CBD process, there is a growing need to assist governments in the implementation of Article 11. There are three main areas of work.

- First, we need to develop a common methodology or approach to biodiversity loss assessment and alongside this, to build the capacity to carry out such assessment.
- Second, there needs to be a more thorough and user-friendly categorization of the array of incentive measures potentially available to promote biodiversity.
- Third, and perhaps most important, governments need to be aware of what incentive measures are actually in place and working effectively. There is no need to "re-invent the wheel" when many excellent cases already exist. Through case studies that allow for a sharing of experiences and lessons learned, governments will be better able to implement economically and socially sound biodiversity incentives.

Through the framework provided by the CBD, economists have a unique opportunity to use the tools of their profession to assist in developing efficient, equitable, and sustainable incentive measures for biodiversity. Parties to the Convention have an opportunity to put in place measures that actually promote the conservation and sustainable use of biodiversity. And multilateral, bilateral, and private supporters of the CBD process have an opportunity to support the design, implementation, and assessment of incentive measures for biodiversity.

## SELECTED READINGS

*There are numerous books, articles, and reports on incentive measures. This introductory list presents some of the more readable writings on the subject.*

**Anderson, Terry L.** and **Donald R. Leal.** 1991. Free market environmentalism. Westview Press, Boulder, Colorado, 142 pp.

**Clark, Dana** and **David Downes.** 1995. What price biodiversity?: Economic incentives and biodiversity conservation in the United States. Center for International Environmental Law, Washington, DC, 68 pp.

**Hudson, Wendy E,** (ed.). 1993. Building economic incentives into the *Endangered Species Act.* Defenders of Wildlife, Portland, Oregon, 123 pp.

**McNeely, Jeffrey A.** 1988. Economics and biological diversity: Developing and using economic incentives to conserve biological resources. IUCN, Gland, Switzerland, 236 pp.

**Owens, Gene M.** (ed.). 1994. Financing environmentally sound development. Asian Development Bank, Manila, 397 pp.

**Panayotou, Theodore.** 1994. Economic instruments for environmental management and sustainable development. UNEP Environment and Economics Unit, Nairobi, Kenya, 108 pp.

## DID YOU KNOW?

- The IUCN is a unique, practically minded association of skilled people, united by a common cause of conserving natural diversity and seeking ways to live sustainably.
- Over 850 states, government agencies, and NGOs are IUCN members. In addition, over 8,000 individuals participate as members of the IUCN's six expert Commissions and other voluntary networks.
- Since the 1980s IUCN has helped over 50 governments and others develop conservation strategies.
- A typical IUCN activity is carried out jointly with a member or partner, which strengthens local institutions and attracts funds for them. It includes a strong emphasis on training, and encourages dialogue — especially through debate, networking, and where necessary, conflict resolution. Finally, the activity informs the public about the environment.

IUCN – The World Conservation Union

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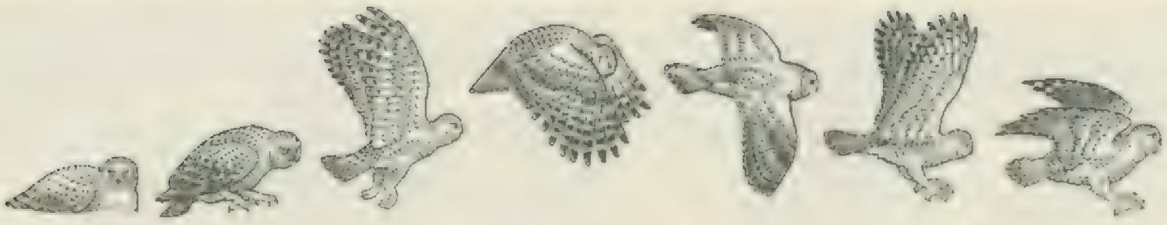

# Implementing the Biodiversity Convention in Quebec

*Jacques Prescott, Ministère de l'Environnement et de la Faune*

*What Quebec, the biggest province in Canada at 1,553,637 km² — more than twice the area of Texas — does for biodiversity, is important for itself, Canada, and the globe as a whole. Already the province has shown initiative by actively participating in the Biodiversity Convention and Canadian Biodiversity Strategy process, moving towards forest management without pesticides, sponsoring biodiversity meetings, and helping fund, in cooperation with the federal government, the new Biodiversity Secretariat office in Montreal. Recently, as Jacques Prescott describes, it has launched a provincial biodiversity strategy and an action plan. [D.E.M.]*

## A COMMITMENT TO SUSTAINABLE DEVELOPMENT AND BIODIVERSITY

In May 1996, at the opening in Montreal of the permanent secretariat for the Convention on Biological Diversity (CBD), the Quebec government announced that it had adopted a strategy and an action plan for the implementation of this important international convention.

These two initiatives are the result of intensive public consultations and interdepartmental dialogue to address the main objectives of this international agreement. They cover all priority areas of biological diversity in Quebec, such as the fauna, the forests, the agricultural and aquatic environments, energy, mines, the Northern environment, biotechnologies, and education. More precisely, they cover ecosystem conservation, sustainable use of renewable resources, conservation and sustainable use of the Northern environment, the rehabilitation of degraded areas, as well as an active involvement in the development and follow-up of international agreements.

Right from November 1992 the government of Quebec has formally adhered to the principles and objectives of the CBD. It now figures among the first governments to have adopted a concrete strategy and action plan in accordance with the various provisions of the Convention. Because the management of Canada's natural resources is a provincial responsibility, Quebec and the other provinces and territories have also contributed to the development of a National Biodiversity Strategy, in cooperation with representatives from all the various areas of activity in Canada. This strategy proposes to Canadians a vision based on 11 guidelines stressing the importance of biodiversity, the responsibility of all Canadians towards the conservation and sustainable use of this heritage, the significance of environmentally sound management of the resources and cooperative action at all levels, as well as the sharing of knowledge, costs, and benefits associated with the conservation and use of biodiversity.

Conscious of the need to establish links between the economy and the environment, the government of Quebec has been striving in the last few years to concentrate its actions on the idea and objectives of sustainable development. Thus, in 1994, the government adopted a strategy for the protection of forests and, in 1995, a strategy for sustainable agriculture. It also carried out exhaustive public consultations in 1995 to develop an energy policy focused on sustainable development.

While tackling the implementation of the CBD, the government of Quebec has insisted on being very realistic and concrete in its approach. Each department imbued itself with the principles and objectives of the Convention and determined the first step for the

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*Jacques Prescott, Centre de coordination et de suivi de la biodiversité, Direction de la conservation et du patrimoine écologique, Ministère de l'Environnement et de la Faune, 2360, chemin Sainte-Foy, Sainte-Foy, Quebec, G1V 4H2, Tel: (418) 644 3352; Fax: (418) 646 6169. Jacques Prescott is also secretary of the Canadian Committee of the IUCN and president of the Union for Sustainable Development.*

implementation, spaced out over four years. The public consultations carried out at all levels of Quebec society were also part of this approach. The strategy action plan resulting from this exercise, aimed at every member of the community, gives a new impulse to the forces already at work.

## A STRATEGY COUPLED WITH AN ACTION PLAN

By stressing the value and the economic importance of biologic resources, the Quebec Strategy and Action Plan have aroused the interest and active participation of departments and agencies responsible for economic development. This collective effort constitutes for Quebec an important step towards an integrated policy for sustainable development.

The Quebec Biodiversity Strategy establishes 30 objectives and identifies close to 200 measures to be implemented. As for the Action Plan, it sets out nearly 500 actions that will have to be carried out in the next four years. This Action Plan, being very pragmatic, will be updated early in the year 2000 to include an extra step towards establishing a fully responsible attitude with regard to biological diversity. In the meantime, all the measures provided for in the Strategy and Action Plan will be integrated into Quebec government plans. The regions, as well as the municipalities and all Quebec communities, are invited to make the Strategy and the Action Plan their own and include them in their development and conservation programs.

To guarantee a close follow-up of all the actions of this ambitious program, the Quebec government has entrusted the Comité intermisisériel sur le développement durable, which comes under the responsibility of the Ministère de l'Environnement et de la Faune, with the production and public release of detailed reports. Moreover, the active involvement of the other players on the environment scene in the implementation of the Quebec government Biodiversity Strategy and Action Plan will be facilitated by the creation of the Réseau québécois sur la biodiversité (RQBD). This network is the result of a close cooperation between federal and provincial departments, and public and private sector agencies and institutions concerned with the conservation and enhancement of biodiversity.

Land of welcome for the permanent Secretariat for the CBD, the province of Quebec hopes that the energy of its commitment to biodiversity and sustainable development inspires and encourages similar initiatives everywhere in the world.

A copy of Quebec Biodiversity Strategy can be obtained from:

Ministère de l'Environnement et de la Faune
Centre de Distribution
2757, rue Watt, Parc Colbert
Saint-Foy, Quebec
G1P 3X3

# Who cares about forest biodiversity?

*Jeffrey A. McNeely, IUCN — The World Conservation Union*

*How valuable are forests? How much forest should we leave alone so that forests can do what they have always done? The answers to these questions guide people and their governments in their management of forests. Over recent decades economic and social forces have shrunk forests for fibre, firewood, and farmland without much thought to alternatives. Government departments with differing goals mean incoherence in forest policies. What other non-fibre values of forests should be on the decision table? How do we respond to differing demands for sustainable forestry? Jeff McNeely asks and answers challenging questions in this article. [D.E.M.]*

## INTRODUCTION

"Biodiversity" entered the public vocabulary about 10 years ago, striking a responsive chord among scientists, decision makers, and even the informed public. It stimulated a comprehensive approach to conservation, bringing information, knowledge, awareness, and ethics into a complex mixture of forestry, protected areas, agriculture, economics, intellectual property rights, land tenure, trade, and so forth. It enabled many of us to break out of our old approaches, such as excluding people from their traditional lands in the name of "conservation," or focusing on one forest benefit to the exclusion of others. As a result, numerous biodiversity studies and strategies have been prepared, and literally dozens of meetings have been held on all corners of the Earth to further develop the concept of biodiversity and to build a global consensus for the actions required to conserve it. The culmination of these efforts led to the signing of the Convention on Biological Diversity (CBD), which has now been ratified by more than 140 countries. What does all this mean for forests, and the biodiversity they contain?

Forests are of special concern to anyone who cares about biodiversity and are the major source of living, three-dimensional structural complexity on land; forests provide a rich and diverse source of habitats, from canopies to root systems, for other species. As Fernside (1990) has pointed out,

> forests are the great biotic flywheel that keeps the biosphere functioning more or less predictably. They are the major biotic component of the global carbon cycle, contain about three times as much carbon as the atmosphere, and their destruction contributes directly to the warming of the earth over large areas, energy balance, water balance, nutrient fluxes, and air and water flows. They are, moreover, the major reservoir of biotic diversity on land: there is no habitat richer in species, none more promising as a source of succour for a swelling, scrambling, grasping human population uncertain as to where its great hopes lie.

## THE ECONOMIC ROOTS OF FOREST DEPLETION

Economists consider the production of a good — such as timber or pulp — to be of economic value only when the total benefits exceed the total costs. However, even if the production of the good is not economic, it may well be profitable in a commercial sense. For example, the way many tropical forests are being harvested is not economic if one considers all the costs, such as the long-term costs to local communities, disruption of watersheds, pollution of rivers, and loss of genetic resources. Harvesting tropical wood, however, is certainly profitable for some individuals and corporations who do not pay the full costs of their exploitation and earn considerable

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*Jeffrey A. McNeely, Chief Scientist, IUCN — The World Conservation Union, IUCN Headquarters, rue Mauverney 28, 1196 Gland, Switzerland; Tel: 4122-999-0001; Fax: 4122-999-0025; E-mail: <jam@hq.iucn.org>*

commercial benefits in the process. Indeed those who are able to externalize most environmental costs may be able to earn the highest profits.

A number of economic factors are driving the loss of forests, or at least the great reduction of their biomass, and biodiversity. Three are worth particular mention here.

**Subsidized energy**

Vast amounts of energy are being provided to modern forestry in forms such as oil, pesticides, and transportation. Most of this is a one-time-only windfall, depending on the productivity of long-dead species that have transmogrified into fossil carbon. These energy subsidies hide the true costs of exploiting the forests, because the prices paid for timber, for example, do not include the costs of replacing the oil consumed in harvesting, processing, and marketing.

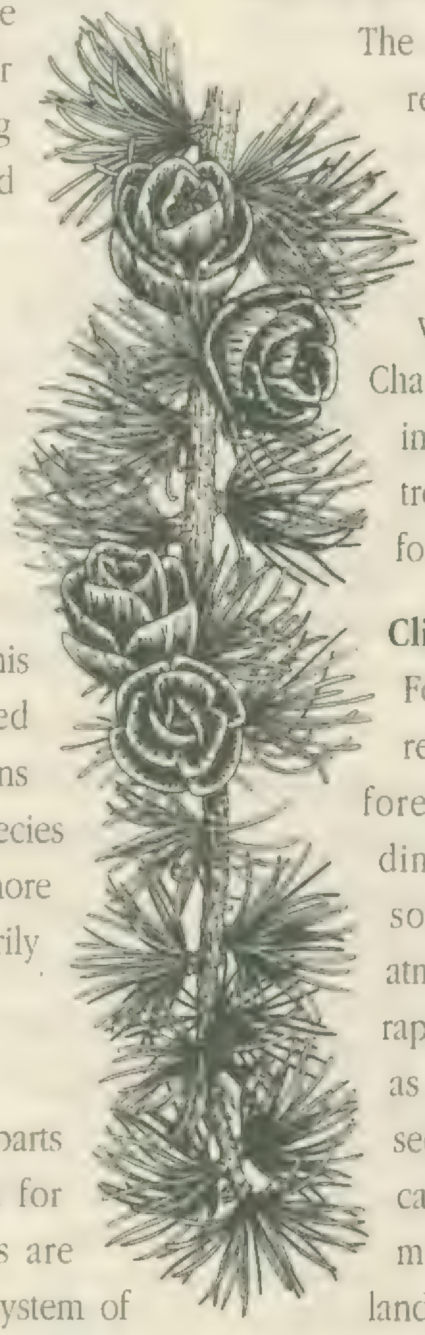
**Focus on single products**

Where people once used forests for a whole range of benefits, including wildlife, medicinal plants, watershed protection, construction materials, and firewood, many forests today are being used to provide only a single product: timber and its derivatives. This single-use focus tends to promote even-aged stands of secondary growth or large plantations of genetically similar trees, often of exotic species in some parts of the world because they are more commercially attractive (though not necessarily more economic).

**Response to global economic forces**

Much of the loss of native forests in various parts of the world has been due to the demand for commodities for export. Local communities are responding to a global, rather than a local, system of supply and demand. Thus, traders do not experience the limits that local agrarian forest managers learned to address through management systems developed over long periods, which tended to limit overexploitation.

In fact, most of the economic forces driving the loss of forests are global in nature. No longer do local people directly benefit or lose, depending on the appropriateness of their practices; now the scale is global, and the "feedback loops" are far wider than they were. Some contend that increased consumption fueled higher productivity levels and encouraged land-use practices that are unsustainable. Once land is deforested, it is often used for agriculture when it really would be more suitable for forests or other uses (Poffenberger, 1990).



## THE ECONOMIC ROOTS OF FOREST CONSERVATION

Economics is also driving the conservation of forests. While the timber industry tends to dominate the discussion in most of the tropics, many other benefits also come from forests (as described in the examples below).

**Water**

Water is becoming an increasing concern for all societies. The importance of forests in the water cycle is reasonably well known, and some people even consider forests as "water factories." Both agriculture and industry depend on the high-quality water provided by forested watersheds. In addition, Goulding (1980), Chao (1992), and others have documented the importance of forests to the rich freshwater tropical fish faunas, where fishes move into forest at times of flood to feed, spawn, etc.

**Climate**

Forests and global climate change are closely related, particularly because of the role of forests in carbon sequestration. While the dimensions of this relationship remain somewhat controversial, it is clear that atmospheric carbon dioxide is increasing at a rapid rate, and that forests are being looked to as at least a short-term carbon sink. Forests sequester around 90% of the world's terrestrial carbon and store between 20 and 100 times more carbon per hectare than agricultural lands. Old-growth forests store up to 350 tons per hectare of carbon, far more than most less mature forest types. Although young plantation forests sequester carbon at a higher rate than mature forests, conserving at least some areas of old-growth forests may be more efficient and have fewer long-term negative ecological, social, and political impacts than establishing new tree plantations for the purpose of carbon sequestration.

**Amenity**

This is a fancy name for the various pleasures that people, such as international tourists or local vacationers, earn from visiting the forest. Tourism is now the world's leading industry, involving nearly US $350 billion per year, and much of the tourism is based on nature; one has only to visit any tourism office to observe that this is the case. One estimate put the total net economic value of outdoor recreation activities in the US at US $122 billion annually.

### Timber

The global timber trade amounts to some US $103 billion per year, most of which comes from the temperate countries, not the tropical countries (contrary to the impression that might be gained from the publicity given to tropical deforestation). In the tropics, about 80% of the estimated 1 billion cubic metres of wood removed annually is used for fuel, providing a significant proportion of energy in rural areas.

### Medicines

Forests are the source of many medicines. Farnsworth and Soejarto (1991) estimate that some 28% of all plants have been used medicinally, and that 121 clinically useful prescription drugs are derived from higher plants, valued at over US $8 billion in 1980. Principe (1991) estimates the pharmaceutical economic value of plant-based drugs in all OECD (Organization for Economic Co-operation and Development) countries at between US $200 billion and US $1.8 trillion annually.

### Non-wood forest products

Other than medicinal plants, this category includes products such as game, fish, nuts, mushrooms, and resins. Many of these products are available especially from old-growth forests, whereas others come from the earlier seral stages of forest development. In total, these have considerable economic importance; for example, Peters et al. (1989) found that the fruits, nuts, and latex produced in part of the Amazonian rainforest near Iquitos in Peru were worth more than the timber produced on the same hectare. Details on the value of some non-wood forest products in Canada can be obtained from *Canada's Biodiversity* (Mosquin, et al., 1995). It also details the kind of ecological services and functions that biodiversity provides to the planet and humankind.

### Aesthetic values

To make the point that many of the aesthetic values can be experienced indirectly, I have separated aesthetics from amenities. Through television, cinema, books, etc., people can earn benefits from the forest without ever visiting one, or have their aesthetic feelings about forests reinforced from a distance. Filion et al. (1988, 1993) have documented, with in-depth surveys, that millions of dollars of this kind of benefit flows from wildlife in Canada, about half of which is from forest lands.

### Research

Many scientists are involved in some sort of forest-based research. This scientific activity is an indication that these habitats are useful for elucidating a whole range of issues of great importance to society.

### Education

Many people value forests as an educational resource, which presents the opportunity to teach students everything from ecology, to philosophy, to anthropology, to forest management, and to aesthetics.

This is not meant to be a comprehensive list of forest benefits, and the mix of benefits received by any country or locality will depend on its own perspectives, needs, and history. But perhaps this list is sufficient to indicate

Table 1.
**Compatibility of forest uses.**
Benefits are rated on a scale from 1 to 5; 1 being "highly compatible" and 5 being "not compatible/not a consideration." The mix of benefits received by any country or locality will depend on its own perspectives, needs, and history, but the greater or lesser compatibility of various factors show the areas where conflict is likely to arise.

| *Table 1* | Clear-cuts | Selective cuts | Non-timber | Water | Biodiversity | Tourism | Carbon storage |
|---|---|---|---|---|---|---|---|
| Clear-cuts | — | 5 | 3 | 5 | 4 | 5 | 3 |
| Selective cuts | 5 | — | 2 | 2 | 2 | 2 | 3 |
| Non-timber | 3 | 2 | — | 1 | 1 | 1 | 1 |
| Water | 5 | 2 | 1 | — | 1 | 1 | 1 |
| Biodiversity | 4 | 2 | 1 | 1 | — | 1 | 1 |
| Tourism | 5 | 2 | 1 | 1 | 1 | — | 2 |
| Carbon storage | 3 | 3 | 1 | 1 | 1 | 2 | — |

the range of benefits that forests provide, and it illustrates the conflicts that are generating the growing public concern over forest management (see Table 1).

## WHO WANTS WHAT FROM FORESTS?

As one result of this growing public interest, many sectors of government are taking an active interest in forests. However, each of the "constituencies" within the government sector has a different perspective about what goods or services are of greatest interest to them. For example, the government sectors listed below might have the following interests:

**Ministry of Forestry**

In most countries, this ministry has the "command and control" function over the nation's forests, often establishing guidelines and oversight for the private sector involved in logging. Most forest ministries give their greatest attention to timber and pay much less attention to amenity and aesthetic values or to non-wood forest products. They may support research that aids their major objectives, and occasionally make an input to education.

**Ministry of Finance**

This ministry is interested in income and expenditures, and therefore is also especially interested in timber. But because the amenity values of forests provide economic gains through tourism, it may emphasize these values as well. In addition, if products such as medicinal plants, non-wood forest products, and water yield returns for the exchequer, they may also be considered important.

**Ministry of Trade**

Again, timber is the most important tradable commodity from forests, but medicinal plants and non-wood forest products may also be important. As well, the Ministry of Trade may be concerned about the forest's effect on climate, since climate can influence trade.

**Ministry of Research**

Although this ministry (or research departments within other ministries) may be interested in the full range of forest benefits, its interests normally tend to focus on the economically most important aspects of the forests.

**Ministry of the Environment**

In contrast to the ministries already described above, the productive or extractive uses of forests are primarily a matter of control or monitoring. Instead, this ministry is more concerned with ecosystem function, including production of water, climate effects, absorption of pollutants, and amenity values. The aesthetic benefits of forests, and research and education are also of great importance to this ministry.

**Ministry of Agriculture**

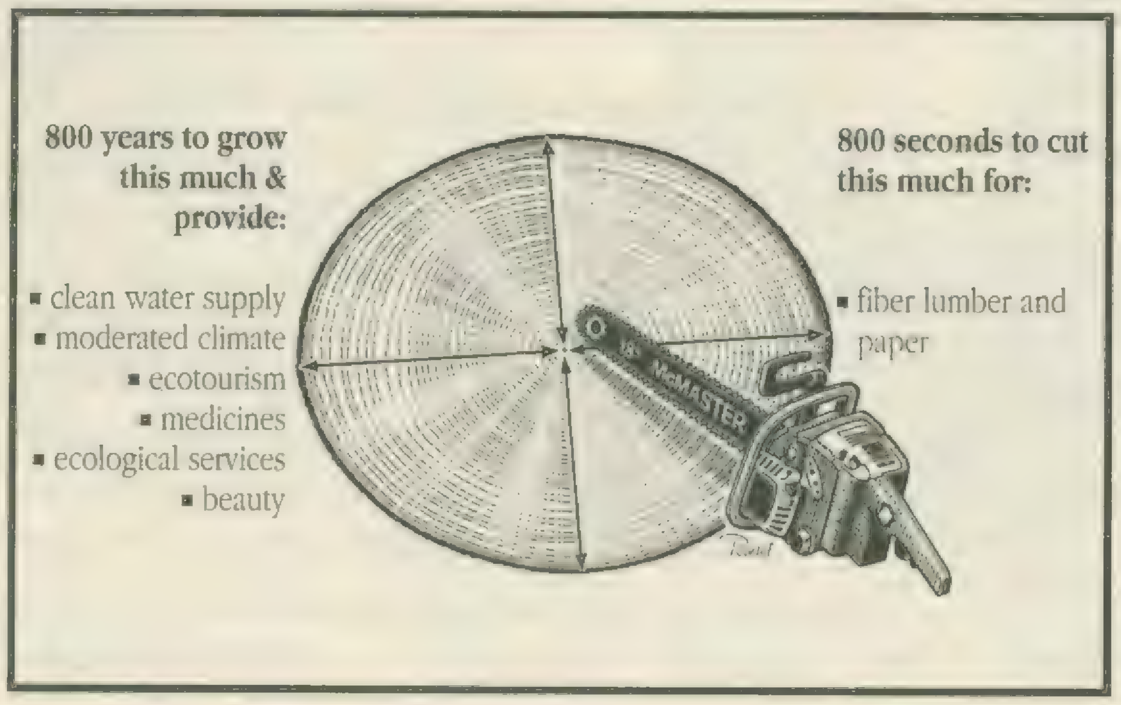
Above all, this ministry is usually interested in high-quality water from forests as an essential input into agricultural production. When the ministry is also responsible for fisheries, it often values forests for the maintenance of appropriate conditions for optimal fisheries production, which brings it into conflict with the timber production objective. To some extent, agriculture depends on forest products as part of the overall agro-ecosystem, as well as research and education.

**Ministry of Foreign Affairs**

Such ministries have been deeply involved in the climate-related discussions, including carbon sequestration. But timber is also a matter for international negotiations. For example, the idea for a forest convention could be discussed in the International Tropical Timber Organization and various other forums. These ministries have also been involved in amenity issues, particularly in relation to biodiversity and in cases where these ecosystems are shared between different nations (e.g., Amazonie). Where water flows internationally, the relationship between water and forests may also be important to this sector.

**Ministry of Industry**

The objective of such ministries in most governments is the promotion of industry, so the main concern is often the uses derived from the forest, such as timber, medicine, and non-wood forest products. Also, many industries require high-quality water as a major input.



**Ministry of Tourism**

This ministry tends to promote the use of forests by tourists, and since tourism is now the world's leading industry, this value is becoming increasingly important. It is supported by the aesthetic appreciation of forests, and the fact that much tourism is water-oriented.

**Ministry of Education**

This ministry is involved in educating the population to be effective citizens, and while relatively few countries have built forestry concerns into their national curriculum, this is probably an appropriate objective.

This of course is only a partial listing, and it could be expanded, with considerably more detail. For example, some ministries of defense may use forests as a defense against invasion from neighbours, while others (such as Brazil) may propose clearing wide areas of forests along international boundaries as a sort of *cordon sanitaire*. Ministries of transport might see forests as potential sites for highways because land acquisition costs may be low. Local authorities have a particular interest in forests as providers of domestic water. And the list goes on. But the general point is clear: many different ministries within a government have significant and legitimate interests in forests, but they perceive the mix of forest benefits in different and sometimes contradictory ways. See Table 2 below for a summary of these conflicts.

## WHO WANTS WHAT FROM FORESTS?

Different interests in the private sector also vary in their interests. Following an approach similar to that taken above, an indicative list that examines various private sector constituencies and their priorities is provided below (and summarized in Table 3).

**Indigenous peoples**

While not necessarily paragons of ecological virtue, many indigenous peoples have special claims on the forests because their livelihood has historically depended on earning sustainable benefits from them. They may consider non-timber forest products (including game, medicinal plants, and various types of food) to be of the greatest importance, and timber a relatively minor product. They often have a special identity with the forest (aesthetic and amenity values), and depend on the water for domestic use, fishing, and irrigation.

**Nearby communities**

While not living in the forest, the nearby communities have an intimate economic link with it. Many people choose to live near the forest because it offers employment — often in the timber industry; others may value amenity or non-timber products, such as game.

Table 2. **Who wants what from forests?: The government sector.** Benefits are rated on a scale from 1 to 5; 1 being "maximum importance" and 5 being "minimum importance/not a consideration."

| ***Table 2*** | FOREST BENEFIT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CONSTITUENCY | Water | Climate | Amenity | Timber | Medicine | Non-wood | Aesthetic | Research | Education |
| Ministry of: | | | | | | | | | |
| Forestry | 4 | — | 4 | 1 | — | 4 | 4 | 3 | 4 |
| Finance | 5 | — | 2 | 1 | 3 | 3 | — | — | — |
| Trade | — | 5 | — | 1 | 3 | 3 | — | — | — |
| Research | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 1 | 3 |
| Environment | 1 | 1 | 2 | 5 | 4 | 4 | 1 | 2 | 2 |
| Agriculture | 1 | 1 | 4 | 5 | 4 | 3 | — | 3 | 4 |
| Foreign Affairs | 3 | 1 | 4 | 2 | — | — | — | — | — |
| Industry | 2 | 5 | 2 | 1 | 3 | 2 | 5 | 4 | 5 |
| Tourism | 2 | 3 | 1 | — | — | 2 | 2 | 5 | 3 |
| Education | — | 5 | 4 | 5 | 5 | 5 | 3 | 2 | 1 |

| **Table 3** | FOREST BENEFIT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CONSTITUENCY | Water | Climate | Amenity | Timber | Medicine | Non-wood | Aesthetic | Research | Education |
| Indigenous people | 1 | 4 | 2 | 5 | 1 | 1 | 3 | 5 | 2 |
| Nearby communities | 1 | 4 | 2 | 2 | 4 | 1 | 2 | 5 | 3 |
| Urbanities | 3 | 2 | 2 | 3 | 3 | 4 | 2 | 4 | 4 |
| Pharmaceutical firms | — | — | — | — | 1 | — | — | 2 | — |
| Timber firms | 5 | — | 5 | 1 | 5 | 4 | 4 | 3 | 4 |
| Academics | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 1 | 2 |
| Conservation NGOs | 1 | 1 | 1 | 5 | 3 | 3 | 1 | 3 | 3 |
| Tourists | 2 | 2 | 1 | 5 | 5 | 3 | 1 | 5 | 3 |
| Posterity | 3 | 1 | 1 | 4 | 2 | 2 | 1 | 2 | 2 |

Table 3.
**Who wants what from forests?: The private sector.**
Benefits are rated on a scale from 1 to 5; 1 being "maximum importance" and 5 being "minimum importance/not a consideration."

**Urbanites**

People who live in cities have a very different perspective, often giving particularly high value to aesthetics — the "forest chic" approach. They may especially value the forest for its amenities during their vacations; and of course, their quality of life depends greatly on forest products, though they are not always aware of this dependence.

**Pharmaceutical firms**

Pharmaceutical firms often benefit from medicines from the forest. The most well-known example is quinine. They may also value some of the research done in forests as it relates to their interests.

**Timber firms**

Above all, timber firms depend on the supply of timber that forests provide, but they also value water, especially as transport or as a way of disposing of effluents. Historically, they have placed relatively little value on other benefits, though this may be changing in response to public interest; some firms are giving far more attention to tourism and other amenity values.

**Academics**

Many academics look on the forest as a good place to do research on a very wide range of topics, as is evidenced by the numerous published articles in the scientific literature.

**Conservation NGOs**

Conservation NGOs put high values on amenity and aesthetic concerns, as well as on climate and water. They also tend to be very critical of the timber industry, and especially of certain management strategies currently being practiced (such as clear-felling).

**Tourists**

Tourists relish the amenity and aesthetic values of forests, water, and climate. As tourists, they are relatively unconcerned with timber and medicinal plants, but may value non-wood products, especially as they relate to hunting and fishing. (When they return from holidays, however, the value they place on timber and medicinal plants may rise.)

**Posterity**

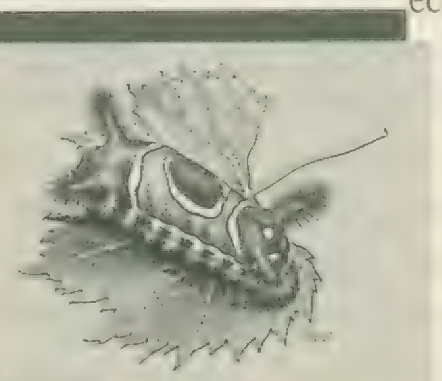
It is impossible to predict what future generations will want from forests, but is it not reasonable to keep options open so that the future generations can decide for themselves how to best use the resources available to them? Education and research may be especially important to future generations, since these tools increase knowledge about the forest. Future generations are probably uninterested in our generation's consumer needs for timber and pulp. However, if the income from these uses is reinvested in ways that benefit future generations, they may well earn considerable benefits from our current forest exploitation.

As with the government sector, this brief analysis of private sector interests in the forest is only partial and indicative; many people play multiple roles in relation to forests. But I think that the message is again clear: many constituencies have a great interest in the way the forest is to managed. Tables 2 and 3 give a rough suggestion as to which of the many benefits provided by forests are of particular concern to which constituency or interest group, suggesting why multiple use of forests is such a topical issue.

## FOUR APPROACHES TO FOREST MANAGEMENT FOR THE 21ST CENTURY

The Statement of Forest Principles approved by governments at the United Nations Conference on Environment and Development in Rio de Janeiro in June 1992 recognized the new political appreciation of multiple use, stating that "Forest lands should be sustainably managed to meet social, economic, ecological, cultural, and spiritual human needs of present and future generations." Ecological science supports this change away from the dominance of clear-cutting for chips or timber and toward a more sensitive and diverse approach to forest management. As Holling (1986) has pointed out, forest ecosystems are dynamic, with futures that are uncertain and unpredictable, so forest management itself must be flexible, adaptive, and experimental at scales compatible with those of critical ecosystem functions such as nutrient flows, hydrological flows, and evolution.

Where the forest industry once exploited a seemingly endless timber supply, political demands for sustainability may eventually force it to seek greater benefits from a smaller quantity of higher quality wood, or from lower quality second-growth forest or plantations. Foresters therefore must seek combinations of forest uses that are compatible (as indicated in Table 1). The various levels of compatibility are certainly open to debate, and they will vary with the locality and the specific management method being applied; but the global trend is clearly away from single-product forestry (at least in principle), and toward diversity and providing more benefits for people living in and around the forests.



Saddleback caterpillar, *Sibine stimulea*. The article refers to certain members of the family *Limacodidae*, the Slug Caterpillar Moths. Most of the 50 North American species, including this one feeding on a grape leaf, can inflict a painful sting with their numerous sharp bristles. Tropical species are more numerous and less well-known, so beware!

Reuters News Service reported in January 1994 that a venomous hairy species of caterpillar, whose sting causes burns and internal bleeding and can kill humans has claimed its fifth victim in Brazil's Rio Grande Do Sul State. Scientists in Rio Grande Do Sul said rapid deforestation over the past few years and the disappearance of predators such as a species of wasp and a fly appear to have led to an increased presence of the stinging caterpillars near towns and cities. The victims had been healthy and there is no known single antidote to the sting.

Given the wide range of interests concerned with the goods and services produced by forests, a mixture of management approaches will be required. In general terms, these might include four main categories:

- protected areas carefully selected on the basis of clearly defined criteria;
- multiple-use forests managed by local people;
- natural forests managed primarily for timber production, but with other benefits accommodated to the extent possible; and
- forest plantations intensively managed for the wood products needed by society.

Each of these types of forests may be managed by different institutions, or indeed any one type might be managed by a range of institutions; each delivers a different range of benefits, as seen in Table 4 on page 22.

### Preservation and protected areas

Since the first modern national park was created at Yellowstone in the US in 1872, over 20,000 protected areas have been established worldwide, including an area now amounting to over 5% of the land surface of our planet. Some regions of the world have well over 10% of their land area designated as protected. While the exact extent of land dedicated to conservation objectives will vary from country to country and biome to biome, a figure of 10% to 12% is often a useful guideline. However, those considering ecological services and conservation of biodiversity would consider that value a minimum. Despite the protection, many protected areas are suffering from a combination of threats including pollution, over-exploitation, encroachment, and poaching.

In a period of growing demands on resources and shrinking government budgets, new approaches are required to ensure that protected areas continue to contribute to society. In Caracas, Venezuela, in February 1992, the IVth World Congress on National Parks and Protected Areas recommended that, first and foremost, protected areas must be designed and managed in order to provide both tangible and intangible benefits to society. This will involve integrating protected areas into larger planning frameworks, expanding support for protected areas, strengthening the capacity to manage protected areas, and expanding international cooperation in the finance, development, and management of protected areas (McNeely, 1992).

### Multiple-use areas managed by local people

In all parts of the world, people live in and around the forest and therefore, they obviously have a particular interest in ensuring that they receive its benefits in a sustainable manner. By pursuing ecologically and economically sustainable forest management practices, they can ensure necessary goods and services for themselves while preserving forest-use options for future generations. This, of course, is an age-old relationship between people and forests — no doubt as old as our species. In its more modern form, this approach is often called "social forestry," or "community forestry," and includes forestry programs that are implemented with the participation of the people who will directly benefit from the programs.

The desire of local people to have the dominant voice in determining their own priorities has not changed over the ages, but their methods have become more effective. This has meant that the "social forestry movement" is now gaining support from foresters in all parts of the world. Foresters working in this field have now started to change their concerns from the quantity of production (and monetary gains) to issues of the general quality of human life and the need for providing sustainable benefits to local people.

To this idyllic picture, a dose of reality must be added. The demands of more powerful centralized governments can have profound impacts on such community-based systems, often in the name of "economic development." Even so, as budget cuts constrain central governments, communal institutions may become increasingly important in areas where forestry is the optimum use of the land, and where these forests need to provide multiple environmental and socio-cultural benefits (Dove, 1993).

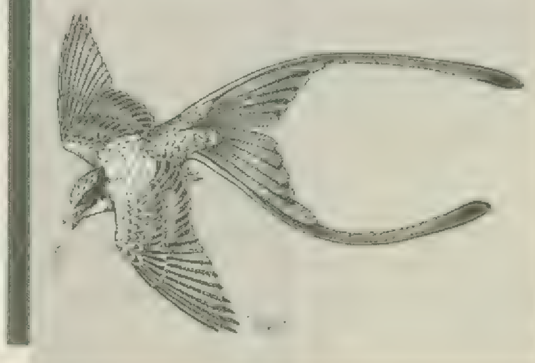
### Natural forest extensively managed for sustainable production of commodities

"Natural forest management" is gaining attention, with a focus on sustainable timber production but with other benefits accommodated as much as possible. Such forests are often under private ownership, or under concession on government-owned lands, with government providing oversight and infrastructure support.

Managing natural forests for sustainable production is more than the venerable idea of "maximum sustainable yield." In many parts of the world, the focus on sustained yield has simplified the forest structure, replacing natural mixed forest with single-species and even-aged monocultures. Commercial tree species have been bred for high productivity and to provide appropriate forms for harvesting and conversion, which has resulted in narrowing the genetic diversity of the forest. Intensifying forest management has involved eliminating competing species, draining wetlands, suppressing natural fires, and greatly accelerating rotation cycles. While intensive forest management practices have led to an overall increase in productivity, at least in the short run, it has been at the cost of a decline of forest quality. Threats to various species of forest-dwelling fauna and the increasing vulnerability to various kinds of pests contribute to the decline of the forest's health. It is clear, therefore, that "sustained yield forestry" is not synonymous with "sustainable forestry"; the latter needs to give greater attention to sustaining various ecological processes and producing a range of other goods and services.

Therefore, managing natural forests may require the establishment of ecological reserves or small protected areas within commercial forests. For example, banning logging within 50 or 100 metres of a river could enable commercial forests to continue to provide wildlife habitat, wilderness travel, aesthetics, erosion control, and so forth, while still earning revenues for the companies involved. Natural forestry management also requires the development and actual implementation of sustainable production systems adapted to the different kinds of forest ecosystems. These would include, among others, the scientific, technological, economic, social, financial, and educational components that are cornerstones of sustainability. To determine the exact mix of goods and services to be provided from any particular forested region means bringing a measure of democracy to the forests and involving the voices of industry, government, academia, hunters, local municipalities, and the environmental community.

Extensive, continuous forests should be preserved because they contain a diverse assemblage of forest-dwelling species, including migrants, and because they are the source of immigrants that can sustain populations of forest migrants in other areas where the forest cover has been disrupted. Insectivorous birds — most of which are migrants — can prevent outbreaks of leaf-eating insects in forests, so a major decline in migrants could effect the health and stability of forests; It is clear, therefore, that small nature preserves may progressively lose their most distinctive species if they are surrounded by a hostile landscape, so the main conservation principle must be maintaining large forested habitats wherever possible (Robert A. Askins, 1995. *Science* 267: 1956–1957).



Fork-tailed flycatcher, *Muscivora tyrannus*

| **Table 4** | FOREST BENEFIT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FOREST MANAGEMENT APPROACH | Water | Climate | Amenity | Timber | Medicine | Non-wood | Aesthetic | Research | Education |
| Preservation | 1 | 2 | 1 | 5 | 3 | 2 | 1 | 2 | 1 |
| Multiple-use areas managed by local people | 1 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 1 |
| Natural forest extensively managed for sustainable use | 3 | 2 | 3 | 1 | 2 | 2 | 3 | 3 | 3 |
| Forest plantations | 4 | 2 | 5 | 1 | 3 | 3 | 5 | 3 | 3 |

Table 4. **Indicative benefits provided by different approaches to forest management.** Benefits are rated on a scale from 1 to 5; 1 being "maximum importance" and 5 being "minimum importance."

### Forest Plantations

As social demands increase, forest plantations will need to be more intensively managed for the wood products needed by people. From the perspective of the tree's biochemical efficiency in converting sunlight into wood, the theoretical maximum timber yield is still far from being reached. For example, Weyerhaeuser Company practices some of the most intensive plantation forestry in the world, but is able to achieve only 40% to 50% of the theoretical yield (natural stands in these areas grow at about 10% to about 25% of the theoretical yield) (Farnum et al., 1983). Forest managers need to master the additional tools provided by modern technology to increase production of timber, pulp, and paper. These modern technological advances, including genetic engineering, whole-tree harvesting, and various chemical applications, will likely be the most effective. Innovations in these areas could lead to significant increases in growth rate and yield. In many countries, it may well be that this land use will come to dominate the productive forestry sector.

It is clear that the technology for accelerating production of timber will need to adapt to changing conditions, and this will require training foresters who are able to apply the latest technologies to growing, harvesting, and processing forests with significant inputs. However, even these "high-tech foresters" will need to be sensitive to the larger needs of society, and present their case to the public in an effective way.

## CONCLUSIONS

It is apparent that the values attached to the different goods and services provided by forests have changed more rapidly and profoundly in the past few decades than ever before. Few of us can reasonably expect these changes to slow down, and in fact, many expect them to continue accelerating. Therefore, the challenges faced by scientists, conservationists, and foresters today are likely to be very different in the future. Similarly, the values society applies to the various goods and services provided by the forest will change profoundly. Discussions of forest biodiversity will be held at COP-3 in Argentina in November 1996. In order to provide benefits to a wide variety of interest groups — all with a legitimate interest in conserving forest biodiversity — it is my hope that the Parties at COP-3 will take a strong stand in support of a diversity of approaches to forest management.

> On Mauritius, the French colonial government passed an ordinance in 1769 that stipulated that 25% of all landholdings were to be kept as forest, particularly on steep mountain slopes, to prevent soil erosion; all denuded areas were to be reforested; and all forests within 200 metres of water were to be protected. In 1803 clearing of forest was forbidden higher than one-third up a mountain side. (Richard H. Grove, 1992. Origins of western environmentalism. *Scientific American* July: 22–27).

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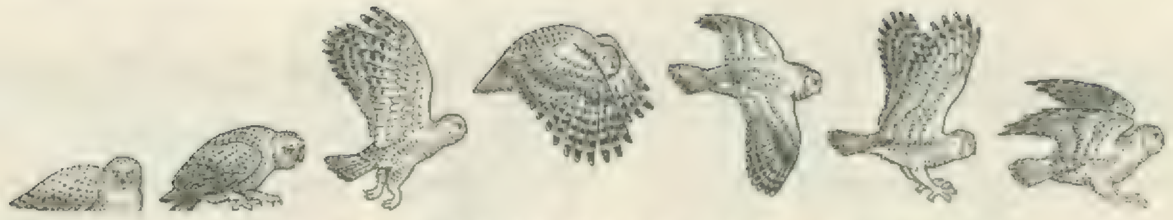

# FACE TO FACE

## with Calestous Juma & Edward O. Wilson

*Ricardo Bayon, Head of Communications, IUCN*

Photo: Don McAllister

Dr. Calestous Juma

*Calestous Juma and Edward O. Wilson come from very different backgrounds: Dr. Juma is a Kenyan scientist and policy analyst who founded and directed an African NGO, the African Centre for Technology Studies (ACTS). He is now working as the Executive Secretary to the Convention on Biological Diversity in Montreal. Meanwhile, Dr. Wilson is an American entomologist, a professor at Harvard University, and a Pulitzer prize-winning author. Both work on the issue of biodiversity and come at it from different perspectives; one from an intergovernmental process, and the other from academia. With such varied backgrounds and areas of expertise, IUCN interviewed them both at the same time, face to face (although it was via telephone, so perhaps ear to ear is more accurate) to see how their perspectives on biodiversity coincided and differed. Despite their histories, we found that they share common views and concerns.*

### ON THE POPULARITY OF BIODIVERSITY

*Dr. Wilson is sometimes credited with having coined the term "biodiversity." In a recent book,* The Naturalist, *he denies this. Nevertheless, asked why the term has become so popular, Dr. Wilson (EOW) and Dr. Juma (CJ) replied:*

**EOW** I think it has become popular because it is easily remembered. In many ways the time had come for a word that encapsulated not only a range of scientific studies on the subject of nature and environment, but also the very widespread social and moral issues connected with biodiversity. It's very widely known in the United States now and in the popular press.

**CJ** I'm not so sure that it is all that popular. It might be popular in the circles in which we interact, but I still meet people who are surprised when they hear the term "biodiversity." They still ask what it means. In this respect, [President George] Bush did us a great favour because when he decided not to sign the Convention on Biological Diversity in Rio, that gave the term some publicity. It made people want to find out what it means.

### ON SETTING BIODIVERSITY PRIORITIES

*Looking at the UN Convention on Biological Diversity, both agreed that it was potentially a very powerful tool. Dr. Juma, however, emphasized that we need to move beyond continued negotiations of the legal instrument to its implementation. Dr. Wilson agreed and felt that implementation would require working at all levels. (Indeed, successful examples of working at all levels are described in Alison Wilson's article on page 3.) He was embarrassed that his country had not yet ratified the*

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*Ricardo Bayon, IUCN Headquarters, rue Mauverney 28, 1196 Gland, Switzerland; Tel: 4122-999-0001; Fax: 4122-999-0025; E-mail: <ccm@hq. iucn.org>*

*Convention, but felt that it would happen in the near future.*

*One issue within the Convention that has become politically difficult is the whole question of determining priority areas. How do we determine where to spend money on biodiversity? There are those who say that we need to identify "hot spots" for biodiversity, places where a variety of key species live, and put our money there. But who determines what species are key, and where money should be spent? Many governments involved in the negotiation of the Convention did not like the idea of an international body telling them what to conserve. Dr. Juma tells us why:*

**CJ** The issue of hot spots became controversial because many countries felt that the international community should not make decisions on priorities that might impinge on their national sovereignty. They do not want to be told by the international community what they should and shouldn't do. It is a question we have not yet resolved. I think we will have to address priorities at the national level since I do not think that a global effort to determine priorities is likely to work.

**EOW** I think the hot-spots concept is extremely important, both scientifically and politically. We must have information, and as quickly as possible, on where the hot spots of the world are. These, of course, are primarily in the tropical countries. Once the hot spots are identified, then individual countries must make their own decisions on what to do with them, based on their own image of their country and their vision for the country's future. Nevertheless, I think that as global awareness of hot spots increases — just as global awareness of political and economic trouble spots of the world increases — there will be a new era, not of coercion, but of encouragement and cooperation to preserve these areas. It is essential that we concentrate our global resources on those key places. Recent studies have shown, for example, in the case of birds (for which we have the most complete database), that some 20% of the world's bird species are found on only 2% of the land surface. This indicates that the judicious use of the hot-spot concept, coupled with more knowledge of where biodiversity is, could lead to cost-effective preservation of biodiversity country by country.

*Asked how priorities would be established, what criteria would be used, and who would make these determinations, Dr. Wilson responded:*

**EOW** That's a scientific determination. It is simply a matter of mapping the distribution of the surviving ecosystems and determining the number of endemic species found there — that is, species that are found only in those places. We can hope to obtain such information over the next 10 to 20 years in far greater detail for a few selected focal groups that are already taxonomically well known, such as birds and other vertebrates, as well as a few insect groups (dragonflies and butterflies), and organisms living in aquatic and marine systems such as fishes, crustaceans, and a few others.

Dr. Edward O. Wilson

Photo: Jon Chase

**CJ** I agree with Dr. Wilson on the need to focus on hot spots, or "critical ecosystems" as they are starting to be known in certain circles. I also agree with him that they provide the mechanisms through which resources can be allocated. But we have to be sensitive to the fact that governments, particularly in developing countries, have viewed this in many cases as an imposition of the expectations of others on what they should and shouldn't do at the national level. Also, it turns out that some of these areas, these hot spots, have the highest concentration of people living in them. This is a good reason to want to protect those areas, but it is also a reason for governments not to want to do anything there because of the political fall-out that might arise from conservation programs.

## SOVEREIGNTY OVER BIOLOGICAL RESOURCES

*The whole question of sovereignty over biological resources has played a major role in the negotiation of the Biodiversity Convention. As one observer put it: "The proposition that biodiversity should be considered as the 'common heritage' of humankind was rejected at an early stage [in the negotiations for the Biodiversity Convention].... Instead, a firm emphasis was placed on sovereign rights over biological resources, while recognizing that the conservation of biological diversity is a 'common concern' of humankind. 'Common concern' implies a common responsibility, something that needs to be addressed by concerted action at the international level." Indeed, the preamble to the Convention first recognizes that biodiversity is a "common concern" and then affirms a country's sovereign rights to their biodiversity.*

*Asked about this juxtaposition, Dr. Wilson and Dr. Juma responded:*

**CJ** The Convention is interesting in that it places considerable emphasis on the rights of nations to determine how to formulate the necessary goals and actions for conservation. This emphasis is based on the understanding that any international treaty has to be translated into national programs. This will undoubtedly mean that countries will want assurance in advance that what they agree to, at the international level, is within their capability to implement at the national level. The same is true in the case of climate change. It should be borne in mind that the concept of sovereignty is...not only applied to genetic resources. We tend to overlook the fact that the institutional arrangements necessary to protect the right of nations to their inventions and to their financial resources are very well established. Indeed, they are among the most powerful institutions around today. I think that that factor should be borne in mind when we discuss questions of sovereignty.

**EOW** Yes. I think that it's been unfortunate that in many of the countries that participated in framing and signing the Biodiversity Convention there is a tendency, as there is in virtually all political arenas, to polarize the issues. Biodiversity was made a red herring by politicians and ideological commentators in many of the countries. In the United States, unfortunately, this issue came to the fore towards the close of the Bush Administration, and Mr. Bush and his advisors made an issue of it in terms of American sovereignty. I know there has been a reciprocal suspicion from the South toward the North in terms of interference with national sovereignty. But I believe that the polarization should be recognized for what it is. We can get around it.

There is now a vast body of information and new potential technologies that can be used to both serve the needs of populations in developing countries, those in the vicinity of hot spots, and to preserve the hot spots at the same time. There are many ways of doing this: through sustainable management of tropical forests, for example, by obtaining more products from such areas without seriously disturbing them; by improving agriculture and industrial productivity of populations that otherwise are virtually forced to intrude on natural environments.

## ACCESS TO GENETIC RESOURCES

*Related to the whole question of national sovereignty is the issue of access to genetic resources. Much was made in the Biodiversity Convention of the fact that, historically, people and companies from developed countries have had free access to the genetic resources of developing countries, while those who have traditionally owned and protected the resources did not receive any benefit from their use. This complicates the issue of sovereignty because those who protect and care for the biodiversity will not necessarily benefit if the profits are channelled through the national avenues. Dr. Juma and Dr. Wilson commented on the issue of access to genetic resources:*

**CJ** The Biodiversity Convention is basically a compromise. It hinges on three factors: access to genetic resources, access to technology, and access to the necessary finances. That is really the balance around which the Convention functions. Now, there are already a lot of rules, laws, procedures, and regulations pertaining to access to technology, but none with regard to genetic or biological resources. To get over this hurdle, the Convention said that countries will allow access on the basis of their national laws, but many of these laws do not exist. So the real challenge now is this: What kinds of laws can be formulated at the national level that would fulfil the objectives of the Convention in order to regulate this access to genetic resources? And that's really the shift from the previous regime, which was one of open access. Now both developed and developing countries are saying: We have added value to these resources, over time, in different ways, such as through the role of local communities or through technological innovation. Given this situation, there should be a return to the countries on the use of these resources.

The issue of sovereignty comes in here because it applies, in the first respect, to regulating access from other countries to resources within a particular country. The second dimension of sovereignty is the ability of the state to regulate and manage matters internally within that particular country, and that's where the conflict with local communities comes in. So, I think we will need to work things out at those two levels: first in the context of international access and second, in the context of the rights and privileges of local communities.

**EOW** I agree with Dr. Juma and I think the whole biodiversity movement — scientific and political — has been of great benefit precisely in this matter of sovereignty and intellectual rights. It has made the world aware that the developing countries, particularly those in the tropics, are rich in biodiversity at the same time as they are poor in per capita wealth. And it is reversed in the developed countries. For this reason, it is entirely to the advantage of developing countries to save and make maximum use of their biodiversity. It is one of the richest resources they have at their disposal, now and in the future. This provides a powerful argument for these countries to encourage scientific research in order to identify their hot spots and endemic species. It is also a powerful argument to continue to refine the rules, laws, and regulations on intellectual property rights so as to provide the maximum benefit to those countries. This will need to be worked on by developing protocols and agreements between countries, as well as between these same countries and the private companies capable of providing venture capital. But all this requires that there be a wealth of knowledge on the fauna and flora in those countries. At present, many do not have this knowledge. So, I think that these two things — scientific research, coupled with the refinement of the regimes regulating intellectual property rights — are the keystones to protecting biodiversity.

In terms of local communities and indigenous peoples, I think that is a wholly different problem, albeit a very important one, but I think that needs to be worked out individually by each country on its own. Here I think the whole issue of national sovereignty becomes very sensitive.

## ON THE ROLE OF ECONOMICS

**CJ** I would say that most of the economic policies of developing and developed countries are heavily loaded against biodiversity conservation. In the Convention we are beginning to look at how economic incentives for conservation can be incorporated into economic policy and planning to help protect biodiversity. It's going to be difficult because the problems are not just in the domain of public policy. A lot of them have to do with the theory of economics, with the way economics functions. I feel economics sometimes puts emphasis only on goods and services whose value we know, often to the detriment of those whose value we don't know. For instance, we have trouble taking into consideration the value of natural resources, so the policies we formulate can be skewed. In other words, our policies can sometimes reflect our ignorance of the economic value of nature. So, in fact, economics functions in an imperfect manner. This can lead to activities that inherently work against biodiversity.

**EOW** I think that Dr. Juma is right and has identified a major defect of economics as a science. By severely restricting themselves to immediate market concerns and measuring productivity in terms of values we know, economists have neglected a large part of the future to the detriment of the environment.

*(For more on these concepts, please see Frank Vorhies article "Incentives for biodiversity" on page 9, and Jeffrey McNeely's article, "Who cares about forest biodiversity?" on page 14.)*

## ON BIOTECHNOLOGY

**EOW** First of all, it is complete nonsense to believe that biotechnology will allow us to recreate species or ecosystems that have been allowed to go extinct. That is a false and dangerous hope. It's also, I think, dangerous to believe that cellular and molecular biology will develop to the point in the foreseeable future of being able to design all of the medicines that we need to control disease and prolong life. It is quite clear that the most rapid progress will be made by using the vast array of molecules that have evolved over millions of years by organisms to fight pests. With that knowledge, biologists will be able to produce some improved products, but they badly need a knowledge of biodiversity in order to make rapid progress.

**CJ** Biotechnology is essentially a way of transforming genetic resources, or biodiversity, into products and services. Like any other technology, it comes with risks and benefits. I think the debate in the Biodiversity Convention needs to be about how to balance these risks and benefits. Unfortunately, what we are having now is a debate on how developing countries are affected by advances in biotechnology, and we are putting this in the context of negotiating a new regulatory instrument, a "biosafety" protocol. Instead, we should be debating how we manage the risk, and that distinction has not yet been made in the Convention.

## ON ECOSYSTEM RESTORATION

**EOW** I think some of the new initiatives underway to help restore ecosystems offer a great deal of hope and provide a psychological uplift for humanity. We should bear in mind that it is probably not possible to recreate an ecosystem that has been entirely eliminated — for example a rainforest if it has been completely cut over. There is no way we could put together all the hundreds of thousands of species, even if they could be saved in some manner. To put them together would be a little bit like unscrambling eggs. But there's a great deal of hope in allowing the remnants of natural ecosystems — a bit of grassland here, a bit of rainforest there — to expand and recover lost ground, and in facilitating this through land preservation and careful cultivation methods.

**CJ** I think ecosystem restoration is an extremely important issue, though we haven't yet addressed it in the context of the Convention. It's unfortunate, but I am sure that when we start to discuss terrestrial ecosystems, which is on our work program for next year, it will figure prominently on our agenda.

## A MESSAGE TO IUCN

**EOW** In a very American expression: Continue to do your damnedest!

**CJ** I think that IUCN could position itself strategically to become a very powerful actor in the implementation of the Biodiversity Convention, and I would welcome ideas on how IUCN could do that.

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### THE PROPOSED CANADIAN ENDANGERED SPECIES PROTECTION ACT

# Will it be effective?

*Cynthia McDougall, Independent Consultant and Educator in Environment and Development*[1]
*Assisted by Stewart Elgie, Member, Federal Task Force on Endangered Species*[2]

*Canada has been active for many decades in developing legislation that protects out natural heritage. This legislation includes parks, migratory birds, fisheries, international agreements like Ramsar, Law of the Sea, etc. But the extent to which Canadian legislation and its subsequent enactment protects endangered species and ecosystems is limited. COSEWIC (see* Canadian biodiversity *1(4):23 and 2(1):23) labels but does not confer protection on species at risk and has mostly ignored "lower" plants and animals (see* Global biodiversity *5(3): 4), and ignores habitat protection for endangered species. Marine areas are scarcely protected in the national parks scheme. A proposed* Endangered Species Protection Act, *which could remedy these gaps, is examined by Cynthia McDougall and Stewart Elgie. Should the new Act contain "habitat" in its title to underline its primordial importance? [D.E.M.]*

## THE STATUS QUO

At present, there are 275 species known to be at risk in Canada. This list (which includes sub-species and distinct populations) ranges from such well-known species as the grizzly bear and several populations of the beluga whale to lesser known species like the eelgrass limpet and phantom orchid. Twenty-one of these species — including the black-footed ferret and the great auk — have either become extinct, or become extirpated (extinct in Canada, but still existing elsewhere). This estimate is actually a conservative one. According to *Canada's Biodiversity* (Mosquin et al., 1995), there are thousands more species that could be listed. So far, only a small proportion of the taxa have been reviewed and out of these, some taxa — like vascular plants — have only been partially reviewed.

While there have been many valuable voluntary efforts and programs, legislation to protect species at risk in Canada has been weak to non-existent. Up to this point, only 4 of 12 provinces and territories have passed endangered species legislation of any kind. Where it exists, such legislation has tended to suffer from significant weaknesses and has almost never been enforced. The case for effective national legislation is written in the continuous decline of species: since 1988 only 6 species have been de-listed from our species-at-risk list, and 3 others have been down-listed. In that same period, 12 species have been up-listed, and over 100 species have joined the list. The 1996 listing process alone saw the addition of 16 new species at risk, and one new extinction.

## THE HISTORY OF ENDANGERED SPECIES LEGISLATION IN CANADA

In signing the Biodiversity Convention in 1992, Canada committed itself to "develop or maintain necessary legislation...to protect threatened species and populations" (Article 8(k)). This commitment was left essentially unaddressed until 1994 when the Canadian Endangered Species Coalition approached then Federal Minister of the Environment Sheila Copps. In response to a petition signed by over 80,000 Canadians, Minister Copps released a federal proposal for a *Canadian Endangered Species Protection Act* on 17 August 1995. This Act outlines what the federal government sees as its responsibilities with regards to protecting endangered

The Canadian Museum of Nature is pleased to provide an open forum for diverse viewpoints even though they may not represent the views of the Museum itself. Comments on these viewpoints are encouraged. Please mail or fax them to the managing editor (address on page 1).

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[1] *Cynthia McDougall, Independent Consultant and Educator in Environment and Development, 3315 West 11th, Vancouver, BC V6R 2J7; Tel/Fax: (604) 736-0894; E-mail: <pmacoun@cln.etc.bc.ca>*

[2] *Stewart Elgie, Member, Federal Task Force on Endangered Species, Suite 300, 106 Front St. E., Toronto, Ontario M5A 1E1; Tel: (416) 368-7533*

species in Canada. In the government's Speech from the Throne in March 1996, with new Environment Minister Sergio Marchi in place, the government re-emphasized its commitment to passing this legislation. Significantly, following the Speech from the Throne, Minister Marchi acknowledged that changes needed to be made to the draft legislation to strengthen it before it is passed. The federal proposal is now open to public comment; it will likely be this public input which makes the critical difference between effective and ineffective legislation.

## WILL THE PROPOSED ENDANGERED SPECIES PROTECTION ACT BE EFFECTIVE?

With this legislation, the federal government intends to create a safety net for all species at risk in Canada. In principle this concept is fine, even laudable — it understands that there is no such thing as protecting just "some" biodiversity. The question is, will the legislative proposal, as it is written now, actually create that safety net?

### Listing

The legislation addresses well one critical step in creating that safety net — it identifies and lists species at risk. It proposes to give legal effect to the current COSEWIC (Committee on the Status of Endangered Wildlife in Canada) body, which has been listing Canadian species at risk based on scientific criteria for 19 years, thereby formalizing the use of a single, independent body for listing.

By establishing a solid listing process, the legislation appears to be on the right track. The obvious corollary to listing species at risk is to follow through with protecting them. This, however, is where the proposed legislation falls flat. The proposed legislation contains a series of weaknesses so critical that they draw into question the validity of the entire undertaking.

### Where does the Act apply?

The first major weakness is that the federal proposal only takes responsibility for protecting species that occur on a narrowly interpreted designation of lands under federal jurisdiction south of the 60th parallel. This includes Canada's oceans, national parks, military bases, etc., for a total of approximately 4% of the land base in Canada. The rest of the species that live on the other 96% of the country are left to the provinces and territories. The problem here is that there is no bottom line. Nothing in the proposed Act requires provinces and territories to create legislation; it is simply expected that they may want to do so because of federal leadership (on its 4% of the country). Of course, provinces and territories have always had the option of, and authority for, protecting species. They have simply never been required to — and still won't be.

The federal government's response to this failure is to encourage provinces and territories to adopt its Spring 1995 discussion document called "A National Approach to Endangered Species Conservation in Canada" as a guide or framework. This non-binding document outlines potential strategies that provinces and territories could use to help prevent species decline. But even if these governments were to follow the National Approach, would endangered species legislation in those areas be effective and enforced? The answer is no.

The National Approach is missing a number of critical elements, and it is in no way enforceable. It fails to include mandatory habitat protection or protection for species from being intentionally killed. Furthermore, it is missing an advance review of projects that will affect endangered species (so that ways to avoid negative impacts may be identified and implemented from the start, thereby avoiding costly remedial actions), and protection on private lands anywhere in Canada. This means that even if all provinces and territories create legislation, according to the National Approach, they will still only be committed to considering the possibility of taking action to protect the species. Under the National Approach, provinces and territories are free to simply allow all endangered species to go extinct.

Finally, if a province or territory decides to turn around and declare open season on all species at risk within its borders, the proposal offers no "fall-back" protection by the federal government. It essentially delegates the protection of species in 96% of the country to the provinces, but then makes that protection optional. When a province or territory cannot or will not protect species, the federal government will not be able to step in because it has already abdicated responsibility. This would be damaging enough if species populations existed only within provincial or territorial boundaries; but given that the majority of species at risk cross human-made boundaries, we are inviting a situation where one province's negligence may wipe out another province's diligence, and the species and the nation are the losers.

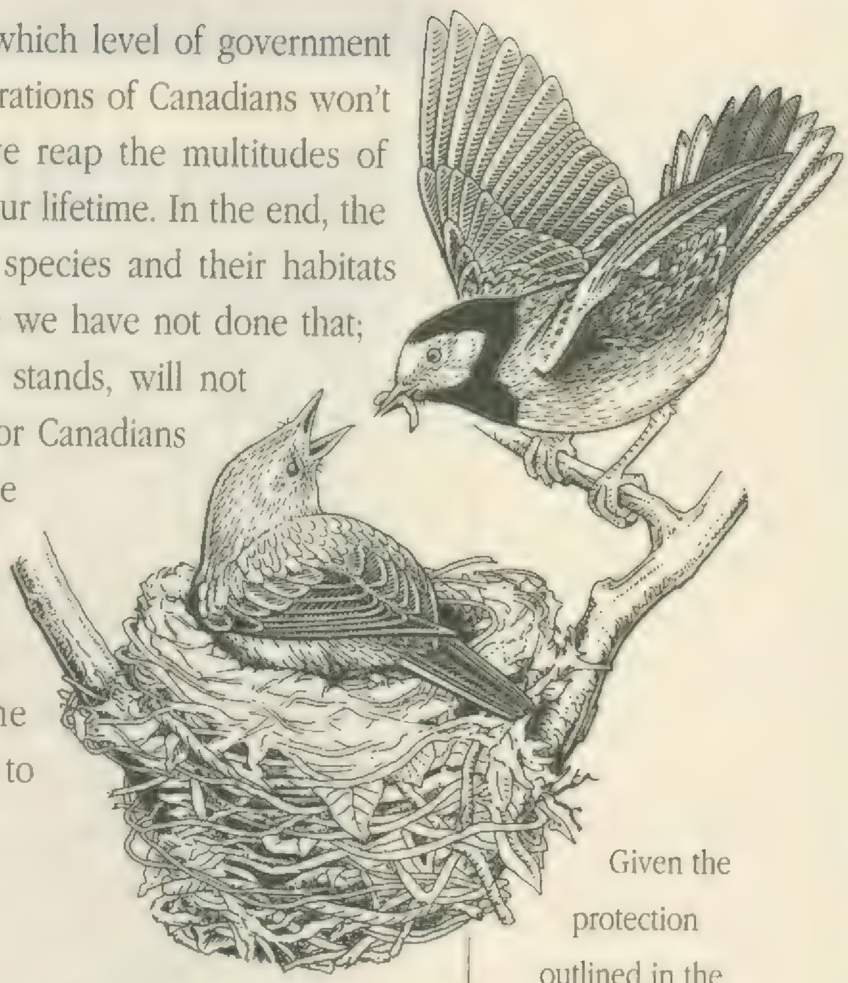
**Missing components**

Moving beyond the issue of where the proposal applies, the next step is to examine whether or not the proposed legislation will be effective even in the small area of Canada where it applies. As pointed out by over 200 of Canada's prominent scientists in a letter to the government in October 1995, several essential elements are conspicuously absent. Most notably, mandatory habitat protection is missing, even though habitat loss is the main threat for 80% of species at risk in Canada. The proposal is also missing what, to the layperson, would seem to be the most obvious component of such legislation — mandatory prohibition against killing. In both case it only suggests that the provinces "may allow for" these elements — the legal term for "entirely optional." Furthermore, like the National Approach, it is also missing the requirement for an advance review of projects that will affect endangered species. Finally, the proposal calls for the preparation of "response statements" for species at risk, but does not require a recovery plan in all cases. In short, the federal government is only obligated to declare its intentions in terms of a species at risk. Even in cases where a species could be protected, the federal government would be free to consciously allow its slide towards extinction.

## THE BOTTOM LINE

This framework can and must be changed. If Canada is to have a safety net for its species at risk, then there must be some national bottom line that covers at least the basics — list them, don't kill them, and protect their habitat — which is respected by whatever level of government implements the legislation. The federal government, at the very least, must include these elements in its area of direct control. If the provinces or territories cannot or will not offer these basics in the areas they manage, then the federal government must be able to step in. The constitutional ability of the federal government to legislate for species protection across the country, either directly, or as a backup to provincial and territorial control, has been confirmed by Canada's leading authority on constitutional division of powers, Dale Gibson (1995). The current federal proposal wholly shortchanges and underestimates this ability.

Species at risk don't care which level of government protects them. Future generations of Canadians won't care. We won't care as we reap the multitudes of benefits of biodiversity in our lifetime. In the end, the essential thing is that the species and their habitats must be protected. To date we have not done that; the current proposal, as it stands, will not do that. It is critical now for Canadians to ensure that the government not pass this proposed endangered species legislation, which is so riddled with holes. The bottom line is, there's got to be a bottom line.



Given the protection outlined in the federal proposal, if a species at risk such as the hooded warbler, *Wilsonia citrina*, spends its time only on land under federal protection (migrating selectively, for example, between a national park, a bird sanctuary, and a federal building in Hull) will it be adequately protected? The answer is, unfortunately, no.

## REFERENCES

**Mosquin, T., P.G. Whiting,** and **D.E. McAllister.** 1995. Canada's biodiversity. Canadian Museum of Nature. Ottawa, Ontario.

**Gibson, Dale.** 1995. A constitutional opinion. Sierra Legal Defence Fund. 26 pp.

*If you wish to find out more about effectively protecting endangered species and their habitat or wish to take action on their behalf, please contact an environmental group in your local area. You can also get more information from:*

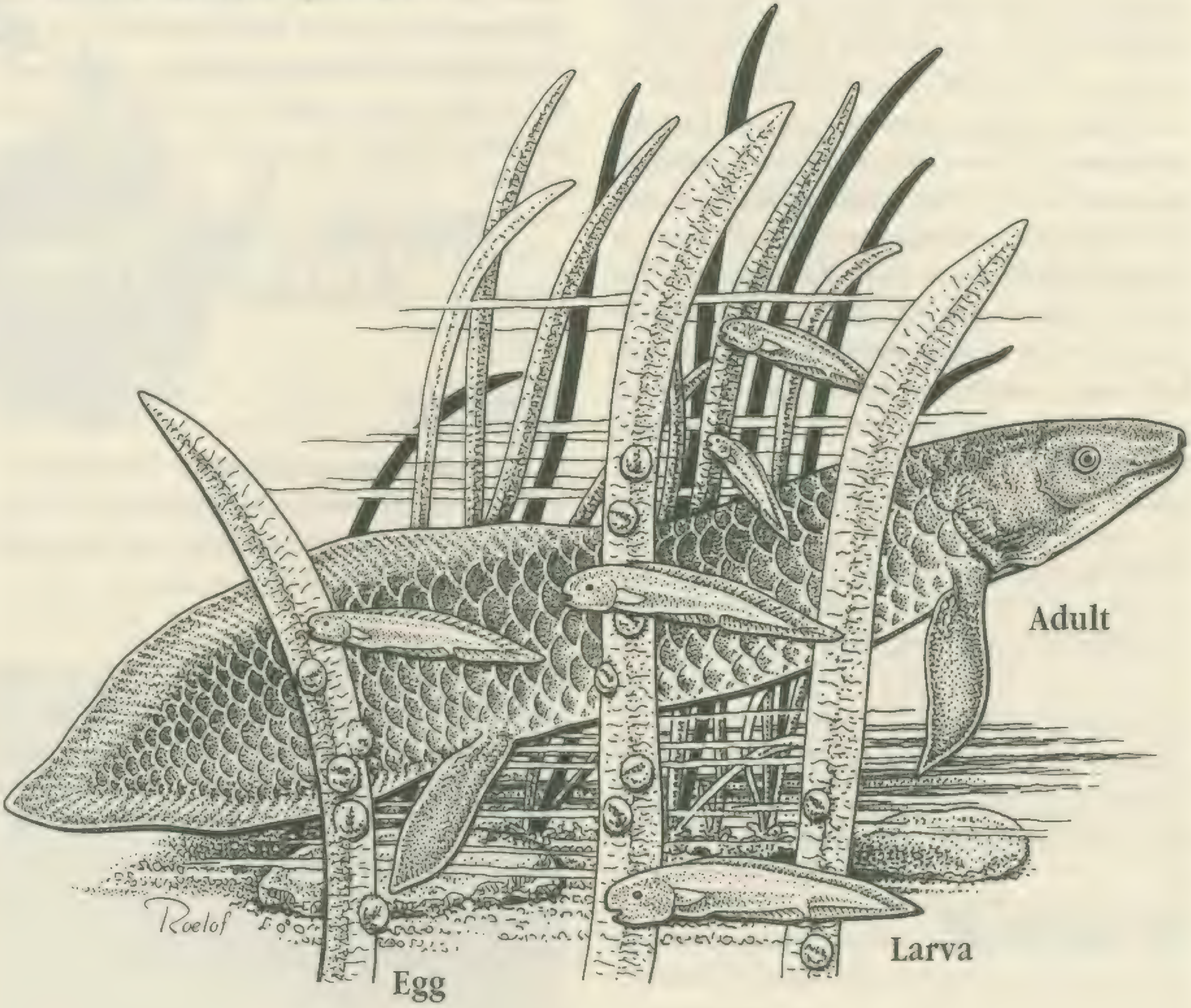
**Catherine Austin**
**Canadian Endangered Species Coalition**
**c/o Canadian Nature Federation**
**1 Nicholas St., Suite 520**
**Ottawa, Ontario K1N 7B7**
**Tel: (613) 562-3447**
**Fax: (613) 562-3371**

*If you wish to express an opinion on the proposed legislation, please contact your local M.P., or write to:*

**Sergio Marchi**
**Federal Minister of the Environment**
**House of Commons**
**Ottawa, Ontario K1A 0A6**
**Tel: (819) 997-1441**
**Fax: (819) 953-3457**

# Australian lungfish

## *Neoceratodus forsteri*



The Australian or Queensland lungfish, *Neoceratodus forsteri*, is the only surviving member of an ancient order of fishes. Its ancestors evolved over 400 million years ago, in the Devonian period. *N. forsteri*'s ancestors originated in the Cretaceous period 100 million years ago. Lungfishes were thought to be the direct ancestors of amphibians but are now considered to have a common ancestor with modern amphibians. Distinctive characteristics of the lungfish that are rather more amphibian than fish-like include the elongate but heavily built body, the single "lung," the gelatinous coating on eggs, a pronounced larval phase, and the fusion of teeth into ridged bony plates. The species has an extremely restricted distribution in Queensland, Australia. Lungfish can grow up to 1.5 m. and can weigh 40 kg. They inhabit still or slow-moving waters, often in deep pools and are essentially carnivorous, eating frogs, tadpoles, worms, molluscs, and small fishes. The modified swimbladder (the "lung") is used only if water quality is very poor. Spawning takes place from August to December. The large eggs (over 1 cm in diameter) hatch in three weeks. The larvae lose their yolk sacs and commence feeding in roughly 2 months; juveniles resemble adults by 6–7 months. Since one component of biodiversity is taxonomic diversity, surely the conservation of one of the oldest branches of bony fishes, believed to be related to the ancestor of land vertebrates, should be a priority for humans.

# SAVE THE LUNGFISH

I'm writing because the poor old lungfish needs your help. Conservationists in Queensland are fighting to save one of the few remaining unchanged habitats of the Queensland lungfish, and we need the help of concerned scientists to get the species, and the environment, fully protected. If the environment is ruined, the lungfish could become extinct. We'd appreciate it if you could send a note to the address below stating why you feel the lungfish is important to science.

The environment of the Australian lungfish, *Neoceratodus forsteri*, is under threat. Three major lungfish habitats in south east Queensland, in the Brisbane, Mary and Burnett Rivers, have already been altered by the construction of weirs and dams, and more water impoundments are planned in the near future. Fluctuating water levels in existing reservoirs damage the spawning sites and juvenile habitats by destroying aquatic plants in the shallows where most eggs are laid, and this reduces recruitment of young fish to the adult population. If the remaining riverine habitats are altered in the same way, recruitment could fall to critically low levels. In addition, detailed scientific studies on the ecology of lungfish in all of its current habitats have not been done, and we do not even have an estimate of the size of the current adult population. Conservation agencies in Queensland are preparing an application to have the lungfish listed in Schedule 1 of the *Endangered Species Protection Act*, 1993.

The lungfish is already protected by Queensland state law, and is on the CITES Schedule 2 list of species threatened by trade. This is not enough. Current demands by agriculture for increasing amounts of water for irrigation could result in changes to the few unaltered stretches of the three major rivers where lungfish are still found, and the species may not be able to spawn successfully in the altered habitats. Despite the fact that the needs of agriculture in the coastal regions affected by the proposed reservoirs could be met by improved management practices, the Queensland Government intends to push ahead soon with two large new impoundments on the Burnett River, where the lungfish was first discovered. To date, the efforts of conservationists have not been able to reverse the proposals to build the weirs, despite private assurances that they are correct in their assessment of risk to lungfish populations, because "a political decision has been made." Conservation agencies in Queensland are appealing to scientists who have an interest in the Australian lungfish to support their application for protection of the habitat and the species.

Please write a short note explaining your perception of the importance of *N. forsteri* for science and send it to: Pam Soper/Wide Bay Conservation Council/29 Watson's Road/Kelly's Creek/Bargara/Queensland 4670/Australia/Fax: 61 71 591919. If it is more convenient, you can e-mail your comments to me at <a.kemp@mailbox.uq.oz.au> and I will pass the messages on to the Wide Bay Conservation Council.

Please take a few minutes to send your comments — the lungfish needs your assistance.

*Anne Warren/School of Zoology/La Trobe University/Bundoora, Victoria/Australia 3083/Tel: 61(03)94792241/Fax: 61(03)94791551/ E-mail: <a.kemp@mailbox.uq.oz.au>*

# Biodiversity news

## Secretariat for the CBD now in business

On 6 May 1996 an official inauguration ceremony for the new Secretariat of the Convention on Biological Diversity (CBD) was held at the Biosphere, Île Sainte-Hélène in Montreal. The inauguration was attended by many visitors from the diplomatic, scientific, and conservation communities, as well as numerous representatives of the media.

Several addresses were made. Ms. Elizabeth Dowdeswell, Under Secretary-General and Executive Director of the United Nations Environment Programme (UNEP), said that nothing can be more important than protecting the biological underpinning of life on Earth. She feels that UNEP is the world's environmental conscience, and that the CBD Secretariat is a key organ in carrying out the dictates of that conscience. According to M. Cliche, Ministère de l'Environnement et de la Faune du Québec, "To pollute is to indebt the generations of the future." M. Cliche pointed out that Quebec was the first province with a plan of action on biodiversity. Clifford Lincoln, Member of Parliament, pointed out how the federal, provincial, and municipal governments worked together to enable the Secretariat to come to Montreal. Premier of Quebec, Lucien Bouchard pointed out that the provincial, and federal governments share responsibilities for sustainable development and committed his government to fulfill its obligations to the Convention. Prime Minister Jean Chrétien emphasized that Canada was very active in protecting the planet's environment and that it had played an important role in the United Nations negotiations at the Earth Summit. Diversity, he noted, strengthens human societies as well as animal and plant communities, alluding to the cultural and linguistic duality of Canada and comparing its advantages to those of conserving biological diversity. A young person, Jessie Macleod, also addressed the audience. She described how the Monarch buttefly migrates between Canada, US, and Mexico, how it belongs to the three countries, any one of which could make it disappear. Another speaker quoted children, giving a definition of biodiversity as "the circle of life," and stating, "we need biodiversity to live."

Prime Minister Jean Chrétien noted that diversity strengthens human societies as well as animal and plant communities. (Photo: Jean-Marc Carisse, Office of the Prime Minister)

The hosts and assembled guests were entertained by a choir of 40 school children, representing several races, whose songs demonstrated harmony in diversity. A reception followed the inauguration. [D.E.M.]

## CCB gets the word out

The Canadian Coalition for Biodiversity (CCB) was formed in late 1994 to increase public awareness and understanding of biodiversity. Achievements to date include:

- Publication of information tabloid on biodiversity hot spots in Canada, sent to 130,000 people
- Preparation of numerous factsheets and an information pamphlet
- Distribution of *Green School Biodiversity Booklet* to schools and outdoor centres
- Distribution of media kit to newspaper editorial boards and reporters in major cities across Canada
- Supplying articles and information to community newspapers
- Supplying camera-ready art to Members of Parliament for use in their householders
- Support of Montreal's bid to house the permanent Secretariat to the

Convention on Biological Diversity

- Sponsorship of annual children's biodiversity poster contest

CCB is not stopping here! In late 1996 and into 1997, watch for the following items:

- Public service announcements, specifically aimed at the youth sector
- Launch of Web site at <http://www.webnet/biodiversity>
- Third annual poster contest. Deadline for entries: 15 January 1997
- Preparation of wall calendar based on art contests
- Provision of input into Canada's position on biodiversity in marine and forestry issues for the 1996 COP to the Biodiversity Convention
- Workshop on agriculture and biodiversity at the IUCN Congress in October 1996

For more information, contact Cendrine Heumer, CCB Coordinator, Suite 412, 1 Nicholas St., Ottawa, Ontario, K1N 7B8. Tel: (613) 241-4611, Fax: (613) 241-2292, E-mail: <biodiversity@web.net>.

## Association for Biodiversity Conservation

The Association for Biodiversity Conservation (ABC) was established in 1995 when a group of professionals and concerned citizens became interested in addressing the biodiversity crisis through a new and alternative non-profit organization. While based in Canada, ABC involves experts from several countries and works internationally.

ABC's mission is to work for the worldwide conservation of terrestrial and marine biological diversity and ecosystem integrity. This is to be accomplished through environmental education, research, practical conservation action, and informed advocacy. To ensure efficient use of shrinking resources, ABC's approach includes working in partnership with other organizations, involving the community in conservation projects, developing and marketing educational materials, and supplying consulting services.

In Canada ABC will work to educate the public about biodiversity and specific conservation concerns with an emphasis on how the individual can make a difference. As well, the group will directly address the problem of habitat fragmentation, which is a serious threat to indigenous biodiversity and a major contributing factor in the population declines of migratory songbirds. To counteract this problem, ABC will focus on applying ecological restoration at the landscape level.

In the tropics ABC will promote and undertake research, public education, and conservation projects for threatened species and ecosystems. ABC will identify priority areas for biodiversity conservation and work with local communities, organizations and governments to find practical, environmentally sensitive development alternatives.

For further information ABC can be contacted at: Association for Biodiversity Conservation, P.O. Box 62, Station B, Toronto, Ontario M5T 2T2, Tel/fax: (416) 221-1534.

## Linnaeus II for Windows is out

Linnaeus II for Windows is the latest version of a taxonomic software package that enables one to find prepared hyperlinked taxonomic descriptions, identification keys, geographic ranges, geological time accounts, and graphics. The new version is compatible with Windows 95; a Linnaeus II version for the Macintosh is under development. The software package assists in preparing accounts of taxonomic groups on a global or regional basis so that the program can develop taxonomic revisions and guides for distribution on CD-ROMs. Two recently published CD-ROMs are "Marine Mammals of the World" and "Etymological Dictionary of Grasses." The accounts will also contribute towards a central World Biodiversity Database (produced by the same company, ETI) that will contain names, synonyms, descriptions, distributions and identification keys to all presently known species on Earth. ETI hopes to link this database up to Species 2000, a global federation of existing taxonomic databases intended to enumerate all known species of plants, animals, fungi, and microbes on Earth. For more information on Linnaeus II contact: ETI Main Office, University of Amsterdam, Mauritskade 61, 1092 AD Amsterdam, The Netherlands, Tel.: ++31-20-525-7239, Fax: ++31-20-525-7238, or e-mail: <info@eti.bio.uva.nl>. [*ETI Partners Newsletter* 3(1): 1–8, January 1996].

## Thank you, readers

*Global biodiversity (Gb)* thanks its readers who took the time to answer the survey sent out last December. Ninety-five percent of respondents found *Gb* easy to read and kept back issues for reference; 87% said that *Gb* does not duplicate material they read in other places. And yes, *Gb* readers do read a lot: each respondent reads at least six other journals or magazines on a regular basis, and most are actively involved in numerous organizations.

About half of the respondents to the question about content were happy with the mix of articles, views, and news in *Gb*, while about 20% asked us to expand these sections. Many respondents especially appreciate the Canadian perspective on biodiversity issues. Comments ranged from "Love the artwork!" to "Excellent resource leads" to "I like the constant reminders about invertebrates, fungi etc....contrasts with much of the overemphasis on birds and mammals in other sources" to "All in all, probably my favourite magazine to read" to "I was disappointed...IMAX does a better job" to "Overall, *Gb* is a really fine activist/scientific publication that is apparently run on a shoestring. You've done just a great job" to "I would like to see *Gb* be more holistic in its coverage of biodiversity" to "Put in advertising to help pay the bills."

Respondents had many wonderful ideas about topics to explore in future issues including permaculture, impacts of logging, mining, and tourism on nature, ecological restoration, environmental education, evolution of conservation data centres, the role of provinces in protecting biodiversity...the list goes on and on and on.

Many readers were concerned about the unnecessary thickness of the paper *Global biodiversity* was printed on. We've listened to you. As you may have noticed, Volume 6 is being printed on a lighter-weight paper stock.

Ideas, comments, suggestions are welcomed anytime. Your feedback on this IUCN theme issue and the summer Marine Biodiversity theme issue is especially encouraged. Our current plan is to offer two theme issues per year.

## STRI and OTS announce research awards competition

The Smithsonian Tropical Research Institute (STRI) and the Organization for Tropical Studies (OTS) announce a second round of competition for research enhancement awards. Awards, supported by the Andrew Mellon Foundation, will provide summer salary and travel for up to three years. Applications are invited from established investigators in all fields of ecological and evolutionary biology to conduct comparative research between STRI and OTS field sites in Panama and Costa Rica. Successful applicants are expected to apply for (or to have in place) other sources of research support. Long-term scientific interaction across these sites is the expected benefit of this program.

Applications will be accepted until 31 December 96. Proposals are limited to five pages of text. The text should outline the significance of the scientific issue being addressed by the research, briefly describe the proposed methods, emphasize the importance of the cross-site compa-rison for this issue and address the potential for long-term interaction across the sites. Previous research performed by the principal inves-tigator (PI) at any of the sites should also be highlighted. In addition, each proposal should include a brief summary of the project (one para-graph), a budget, a budget justification approved by the home institution of the PI, a timetable, a full CV, a conflict of interest statement and an indication of what other sources of funds are in place or will be sought. Address inquiries to Education Office, Smithsonian, Apdo 2072, Balboa, Ancon, Panama *or* Unit 0948, APO AA 34002-0948, USA; E-mail <stri.tivoli.dealbag@ic.si.edu>.

## New exhibit on sustainability in the Arctic underway

The Centre for Traditional Knowledge and the Canadian Museum of Nature have produced a preview of a new Arctic exhibit for the IUCN World Conservation Congress being held in Montreal in October. The exhibit will explore the challenge of ensuring sustainability in the sensitive environments of the North using both traditional and scientific knowledge. The first phase of the exhibit will open at the Museum in Ottawa in Summer 1997 and will focus on creating dialogue between northern communities and visitors to the exhibit. The highlight of the IUCN preview will be an interactive video-conference programme enabling elders and children in Iqaluit to share insights and questions with scientists and children in Montreal.

## President of CMN retires

After 13 years as President of the Canadian Museum of Nature (CMN), Dr. Alan R. Emery retired in June. Dr. Emery was instrumental in transforming the CMN from a traditional museum into a modern dynamic institution. Under his leadership, Museum research has been re-directed to be more important to science and relevant to society. In addition, the CMN's new "risk management" techniques in collections work have become a model for international institutions. Finally, within public programmes, the CMN began to move away from the visitor experiencing the Museum as "a temple of knowledge" to the Museum as a forum for dialogue about nature and society. Dr. Emery also contributed to *Global biodiversity* by sharing his thoughts in the column called "The Last Word". *Global biodiversity* wishes Dr. Emery all the best in his new ventures.

## Hemp update

On 25 June 1996, the Canadian Broadcasting Corporation (CBC) announced that Bill C-8, the *Controlled Drugs and Substances Act*, was passed into law on final reading by the Senate Legal Affairs Committee. The Chair, the Honourable Sharon Carstairs, announced an important amendment: Bill C-8 will exclude hemp fibre and stalks from being defined as narcotic.

This will legally allow the establishment of a new resource industry and will provide tobacco farmers with an alternate agricultural income. By productively using other damaged farmlands Canada-wide, hemp will help reduce the excessive demands on our natural foresty resources. Farmers in Canada can now legally grow hemp to produce specialty papers and strengthen recycled paper, manufacture textiles, and produce construction fibreboard. [Roelof Idema]

# Cyberdiversity:

## Biodiversity and the Internet

### The Tree of Life Project

The Tree of Life Project, a collection of Web pages, had its grand opening on 5 January 1996. Each page contains information about a group of organisms: a phylogeny, introduction, characteristics, discussion of phylogenetic relationships, references, and more. The pages are linked together effectively forming a phylogenetic tree of all living organisms. For example, the Crown Eukaryotes page contains the terminal taxon name Green Plants, which is a hypertext link to the Green Plants page. Interestingly, the Tree has one address and yet, different branches of the Tree reside on different computers. Today there are 948 pages in the Tree on seven different computers on two continents. Both the number of pages and the completeness of each page will grow through time.

The eventual goal is to complete the Tree to the species level in many different groups of organisms. This is being accomplished with the help of over 120 contributors. To celebrate the formal opening of the site, numerous contributors produced pages for various groups including vertebrates, frogs, green plants, beetles, and jumping spiders. There is now a searchable index of taxon names, and lots of pictures! The URL for the home page of the project is: <**http://phylogeny.arizona.edu/tree/phylogeny.html**>.

For more information contact: David R. Maddison/Department of Entomology/University of Arizona/Tucson, AZ 85721/USA/Tel: (520) 621 9781/Fax: (520) 621-1150/E-mail: <beetle@ag.arizona.edu>. Or send correspondence directly to the project at this e-mail address: <tree@ag.arizona.edu>.

### Help build a World Species List

The World Species List (WSL) project, located at Lewes, Delaware, USA, is inviting the electronic community — including scientists, educators, students, curators, taxonomists, publishers of species guides, museums, environmentalists, ecologists, bacteriologists, agronomists, biotechnologists, world organizations, database managers, bird watchers, conservators of intellectual property rights and biodiversity, park directors, and the general public — to assist in building a WSL of plants, animals, and microorganisms.

The WSL will be "too large" to be one individual database. Instead, it will be a database of databases and WSL will maintain the index. Data may be submitted in a variety of formats. Fields in a record could include: a record number (starting with 1 in a given list); Latin binomial/trinomial (i.e. genus-species-variation); common name(s); taxonomic group; geographic region for the list; natural history of the species; protection status; and other.

Level I data will consist of electronic lists comprising existing species data. These lists must be freely accessible, simple text files. List owners update the files. Level II data will make full use of existing data. WSL does not buy or sell lists. To join the WSL mailing list, send the following message: "*subscribe specieslist <your name>*". To remove your name from the list, send the following message: "*unsubscribe specieslist <your name>*" to <**listproc.@envirolink.org**>.

To see the index of lists, visit the WSL home page at: <**http://envirolink.org/species/**>.

A File Transfer Program (FTP) site is currently being used to receive only. Follow this procedure to send documents or lists to the WSL: Login: anonymous/Password: your e-mail address/To: <**ftp://envirolink.org/pub/specieslist/incoming**>.

For more information, Richard Stafursky can be reached at **<rstafursky@envirolink.org>** or **<mavs @panix.com>**.

## Environmental magazine for students

Voyage Publishing has launched a new paperless bi-monthly electronic magazine called *Science and the Environment*. The magazine is written for educators and students at the high school and university level. It aims to provide objective environmental news with colorful photos and graphics that can be either printed or downloaded to floppy disk, then photocopied and distributed to the class.

Each issue will have 80 news stories divided equally among eight chapters: Biodiversity & Wildlife Conservation; Climate & Atmospheric Studies; Alternative Fuels & Energy; Marine Ecology; Health, Population & Agriculture; Clean Air; Clean Water; and Waste Management & Recycling. Each chapter is sponsored by either a major corporation or an environmental organization, which enables the magazine to be distributed free of charge to those who have access to the Web. Stories are drawn from over 500 sources including popular magazines, research journals, and specialized environmental publications. Readers can also view chapter headings, all current headlines, and the Editor's Corner, and find out how to use the chapters in the classroom.

A few of the stories viewed 18 December 1995 included: Scientist Finds the Presence of Songbirds Affects Forest Health (trees fenced off with nets had twice as many insects as control trees); Costa Rican Villagers Balance Conservation with Sea Turtle Preservation (villagers designed a formula for harvesting enough eggs to keep the local economy healthy while preventing exploitation of turtles that could lead to their disappearance); and Scientists Discover Diverse Species in the Treetops of Old Growth Forests (patches of soil on branches of old trees support moss and lichens; these provide nutritional supplements to trees like big-leaf maples that grow additional roots from the branches into the soil patches). Stories checked were a page or two long and accompanied by at least one color photo. The magazine source that the story is summarized from is cited for each article.

To get information on Voyage Publishing or join Voyage's mailing list, e-mail Voyage Publishing at: **<Publish@Voyagepub.com>**, contact Voyage Publishing at: Voyage Publishing/1017 Princess Street/ Alexandria, Virginia 22314/USA, Tel: (703) 299-9575, Fax: (703) 299-9574, or visit their Web site at: **<http://www.voyagepub.com/publish>**. [D.E.M.].

## Central Appalachian Biodiversity Project announces new Web site

A new Web page has been created by Matt Peters (University of Pittsburgh) for the Central Appalachian Biodiversity Project (CABP), which is based in Hedgesville, West Virginia, USA. The site provides links to Heartwood and other groups working to bring ecological sanity to the Appalachians. The CABP home page will provide timely information pertaining to the Central Appalachian bioregion. Biologists, philosophers, educators, and citizen activists will find items of interest here. I urge everyone to check the site regularly. The address is: **<http://www.envirolink.org/orgs/cabp/>**.

The home page is still under construction, but more information will be added and the page will be updated on a monthly basis. Any one wishing to contribute to the CABP home page may contact: Charles Sullivan, Project Coordinator, Appalachian Restoration Campaign (ARC), Central Appalachian Biodiversity Project, Route 3, Box 390/Hedgesville, WV, USA 25427, Tel/Fax: (304) 754-9161, E-mail: <cesull@ix.netcom.com>.

## L'Union québécoise pour la conservation de la nature (UQCN)

This organization groups individuals and organizations that work in natural sciences and the environment, and UQCN is one of the more important environmental networks in Quebec. UQCN aims to maintain ecological processes essential to life, preserve genetic diversity, and ensure sustainable use of species and ecosystems. Visit their home page at: **<http://www.cgocable.ca/commerce/uqcn/site.htm>**.

## Global Agriculture Biotechnology Web Site

The Global Agricultural Biotechnology Web site can be found at: **<http://www.lights.com/gaba/index.html>**. This site contains information on the Agricultural Biotechnology International Confe-rence 1996 involving animal science, crop development, microbials, technology transfer, and business. Speakers will address issues such as forage and food crops to aquaculture, forestry, finance and international trade.

## European Centre for Nature Conservation

The up-to-date version of the Bern Convention can be found at: **<http://www.ecnc.nl/doc/europe/legislat/bern.conv.html>**.

Other pages of the site contain the English text of the European Union Habitats Directive and the Pan-European Biological and Landscape Diversity Strategy, as well as other relevant nature conservation information including a directory of organizations.

## Environmental studies program in Scotland

A new environmental studies program has been announced at Findhorn College, Scotland. Findhorn is an innovative Scottish college with a unique international environmental studies program. Students can come to the college for an undergraduate semester or year abroad, for graduate study at the masters level, for research at the doctoral level, or for summer courses and special programs. The URL of the college's Web page is: **<http://www.tiac. net/biz/fcie>**.

## Natural history book URLs

Looking for a certain book in the realm of natural history? Perhaps these services can help you. The U.K. Natural History Book Service can be found at **<http://www.nhbs.co.uk/nhbsmain.html>** or try The Edward Arnold Bookstore at **<http://www.bookshop.co.uk/Arnold/>**. Faxon, a library subscription/book purchasing service, maintains a list of all publishers' home pages on the Web at: **<http://www.faxon.com/internet/publishers/pubs.html>**. [With thanks to Julia Innes]

## From Florida — Environmental news on a daily basis

The first daily summary of state environmental news in the US is now on the Internet. "EnviroWorld" features a daily summary of Florida's environmental news, original stories, a daily federal environmental news feature, and a regularly updated environmental classified section. "EnviroWorld" is now evaluating which additional states can be added to the daily news service. Reach them at URL: **<http://www.enviroworld.com>**.

## Global Change Master Directory

The Global Change Master Directory (GCMD) is a comprehensive directory of earth science and environmental data. Through data-set descriptions and contact information, the GCMD provides the scientific community and the general public with easy access to scientific data. Currently there are about 4,000 data-set descriptions, covering the fields of meteorology, oceanography, geology, ecology, hydrology, geophysics, GIS, and remote sensing. Visit GCMD at: **<http://gcmd.gsfc.nasa.gov>**.

## Biodiversity Convention Clearing House Mechanism on-line

The first phase of the Clearing House Mechanism under the Convention on Biological Diversity (CBD) went live on 6 May 1996. The launch coincided with the official opening of the Secretariat of the CBD. People are encouraged to visit the site and promote its growth and use. It can be reached at: **<http://www.istar.ca/biodiv/>**.

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E-mail: rpf@flash.net

**Ultraviolet Light** in Canada now reaches levels where the recommended time outdoors without sunscreen is 20 minutes or less during summer middays. Measure UV levels with the BW-10 Personal UV Monitor. This easy-to-use device gives the UV INDEX reading instantly, whether on the beach, walking, canoeing, etc. Use the BW-10 to decide how much time to spend in the sun, what sunscreen to use and what protective clothing to wear. Contact Vital Technologies Corporation, (905) 951-1219, Bolton, ON, Canada.

# Biodiversity meetings

**7–11 OCTOBER 1996**
**International Conference of Ecological Engineering**, to be held in Beijing, China.

**Contact:** Prof. Chengqing Yin, Research Center for Eco-Environmental Sciences, CAS / China, P.O. Box 2871, Beijing, China, Tel: 86 10 2554806, Fax: 86 10 256 2775, E-mail: <skleac@public.bta.net.cn>

**23–30 OCTOBER 1996**
**Networking in Action for Sustainable Forest Development,** to be held in Chihuahua City, Mexico.

**Contact:** Gina Uribe, Gustavo Herdia or Cliff Matthies, Chihuahua Model Forest, Tel/Fax: (52) 14-15-87-06

**28–29 OCTOBER 1996**
**International Symposium on Assessment and Status of Pacific Rim Salmonid Stocks**, to be held in Sapporo, Hokkaido, Japan.

**Contact:** Hisashi Endo, NPAFC Secretariat, 6640 Northwest Marine Drive, Vancouver, BC, V6T 1X2, Tel: (604) 228-1128, Fax: (604) 228-1135, E-mail: <endo@unixg.ubc.ca>

**29 OCTOBER–1 NOVEMBER 1996**
**International Conference on Water Resources and Environment**, to be held in Kyoto, Japan.

**Contact:** Water Resources Research Center, Kyoto University, Kyoto, Japan, Tel/Fax: 774-32-3093, E-mail: <conf@wrcn2.dpri.kyoto-u.ac.jp>

**4–7 NOVEMBER 1996**
**Eco-Informa '96**, to be held in Lake Buena Vista, Florida, USA.

**Contact:** Robert Rogers, ERIM, Box 134001, Ann Arbor, MI, USA 48113-4001, Tel: (313) 994-1200 ext 3382, Fax: (313) 994-5123, E-mail: <rogers @erim.org>, Web site: <http://www.erim.org/CONF/conf.html>

**4–15 NOVEMBER 1996**
**3rd Conference of the Parties to the Convention on Biological Diversity**, to be held in Buenos Aires, Argentina.

**Contact:** Secretariat to the Convention on Biological Diversity, World Trade Centre, 413 St. Jacques St., Office 630, Montreal, Quebec H2Y 1N9, Tel: (514) 288-2220, Fax: (514) 288-6588

**21–23 NOVEMBER 1996**
**Mote International Symposium on Marine Stock Enhancement: A New Perspective**, to be held in Sarasota, Florida, USA.

**Contact:** Felicia Coleman, Ph.D., Mote Symposium, Center for Professional Development, Florida State University, Tallahassee, Florida, USA 32306-2027, Tel: (904) 644-2019, Fax: (904) 644-9829, E-mail: <coleman@bio.fsu.edu>, Automatic reply: <slampman@mailer.fsu.edu> (put Mote Symposium on the topic line)

**3–6 DECEMBER 1996**
**Biodiversity, Conservation and Management at the Beni Biosphere Reserve,** to be held in La Paz, Bolivia.

**Contact:** Carmen Miranda, Academia Nacional de Ciencias de Bolivia, Av. 16 de Julio, Casilla 5829, La Paz, Bolivia, Tel/Fax: (591) 2 350612, E-mail: <cmiranda@ebb.bo> or Francisco Dallmeier, Smithsonian / MAB Biodiversity Program, 1100 Jefferson Dr. SW, Suite 3123, Washington, DC 20560 USA, Tel: (202) 357-4793, Fax: (202) 786-2557, E-mail: <icfgd@ic.si.edu>

**29–31 JANUARY 1997**
**Federal and International Scientific Permits.** A workshop for natural history museums and collectors, to be held at the San Diego Natural History Museum, San Diego, California, USA.

**Contact:** Sally Shelton, Director, Collections Care and Conservation, San Diego Natural History Museum, P.O. Box 1390, San Diego, California USA92112, Tel: (619) 232-3821, Fax: (619) 232-0248, E-mail: <libsdnhm @class.org>

**17–19 MARCH 1997**
**Fourth Thematic Conference on Remote Sensing for Marine and Coastal Environments**, to be held in Orlando, Florida, USA.

**Contact:** Robert Rogers, ERIM, Box 134001, Ann Arbor, MI, USA 48113-4001, Tel: (313) 994-1200, Fax: (313) 994-5123, E-mail: <rogers@erim.org>

**24–30 AUGUST 1997**
**9th International Congress of the European Society of Ichthyologists**, to be held in Trieste, Italy.

**Contact:** Pier Giorgio Bianco, Executive Secretary, SEI, Dipartmento di Zoologia, Via Mezzocannone, 8, I-80134 Naples, Italy, Tel: 39 81 5527089, Fax: 39 81 5526452

**2–14 SEPTEMBER 1997**
**The Summit of the Sea**, to be held in St. John's, Newfoundland.

**Contact:** Dave Finn, Summit of the Sea 500th Anniversary Corporation, P.O. Box 1997, 1 Crosbie Place, St. John's, Newfoundland, A1C 5R4, Tel: (709) 579-1997, Fax: (709) 579-2067, E-mail: <david_finn@ porthole.entnet.nf.ca>

# Book and periodical niche

## In cold margins: Sustainable development in northern bioregions

By J.M. Jamil Brownson. 1995. Northern Rim Press, Missoula, MT. Paperback ISBN 0-96-40086-7-x, $23.00.

The global biodiversity crisis is symptomatic of many of the problems facing humanity at the end of the 20th century. The proffered solutions to many of the simultaneous problems of biodiversity loss and human misery are often couched in terms of sustainable development. This book usefully extends the policy debates on both in a unique manner. As such it is worthy of a wide readership by anyone interested in rethinking human uses of the natural environment. Attractively designed and laid out, this book is suitable for a wide audience of policy makers, environmental activists, and citizens of the northern regions. The text is not cluttered with detailed academic references, but an annotated bibliography lists the key sources cited in the text and provides a truly eclectic collection of relevant background reading. Illustrations, drawings, and a few maps add to these accessible and regionally sensitive portrayals of the landscapes of the North.

While most books on the subject of sustainable development focus either on the question of rethinking the economies of developed or on underdeveloped states, this unique volume focuses on these matters in terms of a regional approach. Principally concerned with the boreal forest areas of the northern hemisphere, the author looks at the various bioregions that stretch around the planet south of the Arctic. The rich and detailed overview of the relationship of human history to specific northern bioregions is an integrated analysis of the human and natural causes of ecosystem destruction and consequent biodiversity loss. The analysis of cultural diversity and its relation to the changing uses, and abuses, of the natural resources of the Northern frontier of human settlement provides some key connections often missing from more conventional ruminations on the themes of sustainable development.

This strategy of thinking about the context in which sustainable development has to be formulated allows for fascinating comparisons between Eurasia and North America and between places with very different histories such as Norway, Siberia, British Columbia, and Hokkaido. The book situates the human histories both within the specific contexts of the local bioregions as well as within the larger human economic and political story. In the process, the difficulties of imagining sustainable lifestyles in harsh terrains are made clear, but these obstacles never exclude the possibilities for reconstruction and innovative local planning. While much of the tale is one of resource exploitation and human hardship, the book emphasizes that there are examples of more benign social and ecological practices scattered across the region. They illustrate the crucial point that there are already some practical models of human use of these environments that are not as destructive as most.

Above all, this book emphasizes that although sustainable development in this region will have to be thought through in regionally specific terms, the larger political changes and the integration of the North into the production patterns of the global economy cannot be ignored. Brownson argues convincingly that until the practices of industry and the rampant culture of consumerism are tempered by more socially responsible modes of economy, sustainable development is likely to remain an unreachable desideratum. Local planning, new technologies, and innovative design offer considerable potential for innovative uses of timber resources and the possibility of maintaining viable communities in the forests. But if the promise of contemporary gentrification and recreational uses of environments in northern North American communities is to be fulfilled, local political control and the willingness to think in terms of sustainable livelihoods in a local environmental context will need to be fostered.

Brownson brings his rich experience as a cultural geographer to the discussion of the causes of environmental destruction and, in many places, the social malaise in Northern bioregions. His art as a geographer is at its best in his synthesis of natural history, anthropology, political economy, and the sense of place of the regions he surveys. But here these synthetic tools are taken beyond the rich interpretation of specific places and applied to the task of rethinking development in terms of sustainability. The regional approach is a useful corrective to analyses that too readily generalize about principles of sustainable development. Indeed the strength of this book is precisely that it makes abundantly clear that sustainability can only really be seriously considered when both the environmental and cultural diversity of particular communities and their regions are understood in their unique specificity.

*Simon Dalby, Carleton University, Ottawa, Ontario*

## Biodiversity measurement and estimation

Edited by D.L. Hawksworth. 1995. Chapman & Hall, NY. Hardcover ISBN 0-412-62480-x. US $69.00.

Somewhat to their chagrin, systematists have been finding out, in nearly all groups of organisms, that estimates of global biodiversity are far exceeding their wildest dreams. Just when someone thinks they have a taxonomic revision completed, somebody turns up a half-dozen or dozen new species. New genera are now the rule and not the exception in the course of study of most groups of insects and other terrestrial arthropods — new tribes and even subfamilies are turning up with some frequency. What does all this tell us?

In the 250 or so years since Linnaeus, we have collectively described some 1.4 million species — a drop in the bucket as far as our expectations are now concerned. But as we have been slogging away at the task of describing biodiversity, biodiversity has been declining and it is now the general opinion that this decline is in high gear and biodiversity is in a crisis situation. This crisis arises not only because increasingly large numbers of species are being pushed to the brink of extinction, but also because the resources necessary to deal with addressing the issue, both in terms of expertise and funding, are inadequate and seem sure to continue their recent steady decline. Throughout the world, the story is the same — funding for systematics, the science that studies the nature and extent of biological diversity, is now drying up. Since we do not have the time or the resources to describe biodiversity, how are we to best spend the next 10 years, let alone the next 250 years? Considered carefully, I think this book directs us on how to make that decision.

When I first read the articles in "Biodiversity Measurement and Estimation," I was struck by how I could see nearly each article relating to my own work in systematics, and for that matter any work in systematics. No, the articles do not describe 20 new insect species, nor do they provide insights about novel methods of collection or classification. Much more importantly, and in a much broader context, these contributions actually direct one on how to take basic information about species diversity and distribution in a given taxon and apply that knowledge in a much more general, and thus valuable, manner that directly addresses critical issues about biodiversity distribution, conservation, and wise stewardship. Certainly, they make examples of specific taxa but the same underlying theme is always evident — as an example, what can data about hummingbird distributions tell us about diversity in montane Central American forests; more generally, how do we take information derived from specific taxa and apply it in a more general and thus more relevant manner?

There are eleven chapters in the book. In the first chapter, Robert May looks at how to measure the actual extent of global biological diversity; Embly et al. examine molecular diversity at higher taxonomic levels; Niklas and Tiffney look at plant diversity in a paleontological perspective; Faith discusses how to incorporate measures of phylogenetic content into measurements of biodiversity; Templeton looks at how genetic variability is measured and the role it should play in population management; O'Donnell et al. examine the measurement of biodiversity in oft-ignored microorganisms; Pearson looks at what attributes make for good bioindicators; Lovejoy discusses the need for actual measurements of biodiversity; Prance attempts to use diversity of higher plant taxa to predict species diversity; Colwell and Coddington, in what I consider to be perhaps the most important paper written about biodiversity, demonstrate how we need to use estimation and extrapolation as much as possible in addressing the biodiversity crisis; and last, Hammond discusses how to estimate diversity in hyper-diverse groups where we truly only know a very small portion of the fauna.

All articles are exceptionally written and very readable. A small table of contents for each article, in addition to the abstract, helps one quickly digest the focus and conclusions of the paper. There is a cumulative index that is very helpful. Like the articles, the same continuous theme of concentrating on "issues," not "taxa" underlies the index.

Although I could not find any reference to the fact (why I do not know), this book is a reprint of a collection of articles first published in July 1994 in the *Proceedings of the Linnean Society in London* (345 [1311]: 1–136). I liked it a lot then — I like it even more now! At 140 pages this is not a big book, but I predict that its contribution to the study of biodiversity and resolution of the biodiversity crisis will prove to be immense.

*Bob Anderson, Entomologist, Canadian Museum of Nature*

## Arctic and alpine biodiversity: Patterns, causes and ecosystem consequences

Ecological studies 113. Edited by F.S. Chapin III and C. Körner. 1995. Springer-Verlag, Berlin, Heidelberg, New York. 332 pp. ISBN 3-0-57948-6. US $143.00.

Most of this book is the product of a workshop that was sponsored by the National Science Foundation and the Swiss IGPB National Committee. Contributors from more than seven countries and ten states in the US were brought together between 17 and 20 August 1993 in Norway at the Kongsvold field station (situated where arctic and alpine biomes merge). Long discussions on the future of biodiversity and its consequences in cold-dominated ecosystems occurred, and these are reflected in the comprehensive and thought-provoking way with which the subject matter is dealt.

A synthesis is provided of the patterns, causes, and consequences of biodiversity in the cold-dominated arctic and alpine ecosystems that cover about 8% of the terrestrial surface of the globe. These ecosystems (5% arctic, 3% alpine) stretch from 80°N to 67°S and reach elevations of more than 6,000 m in the subtropics. The ecosystems are similar in area to the boreal forests and all the crop land on Earth. Arctic and alpine ecosystems are the only biome with global distributions, making them ideal for global monitoring of environmental change. While both are cold-dominated, the authors discuss where they are similar, and where they are strikingly different.

Arctic and alpine ecosystems are presented as critical, and as providing unique insights into causes and consequences of diversity in general because:

- high latitudes are predicted to undergo more pronounced warming than other regions of the globe;
- cold regions are the areas where climactic warming will have the greatest ecological consequences;
- high altitudes, due to reduced pressure, are regions where $CO_2$ would be particularly limiting and where rising $CO_2$ might strongly stimulate plant growth;
- arctic ecosystems, with their large frozen pools of carbon and methane, may affect global climate; and
- due to their relative simplicity, these ecosystems may show the clear effects species have on ecosystem processes and may, therefore, be strongly affected by the loss or gain of species.

The book is divided into three sections. The first seven chapters document patterns and causes of genetic and species diversity of plants and animals, emphasizing the interaction between historical and contemporary factors in governing biodiversity. The second section (six chapters) addresses the way biotic diversity has changed in the past, how it is currently changing, and how it will likely respond to future changes in climate and land use. The third section (eight chapters) treats both the conceptual basis and the evidence that biodiversity influences the functioning of arctic and alpine ecosystems. Each chapter is summarized by a list of conclusions and followed by extensive references to the subject material in the chapter. The editors provide a short final chapter that is a synthesis of the contents of the book.

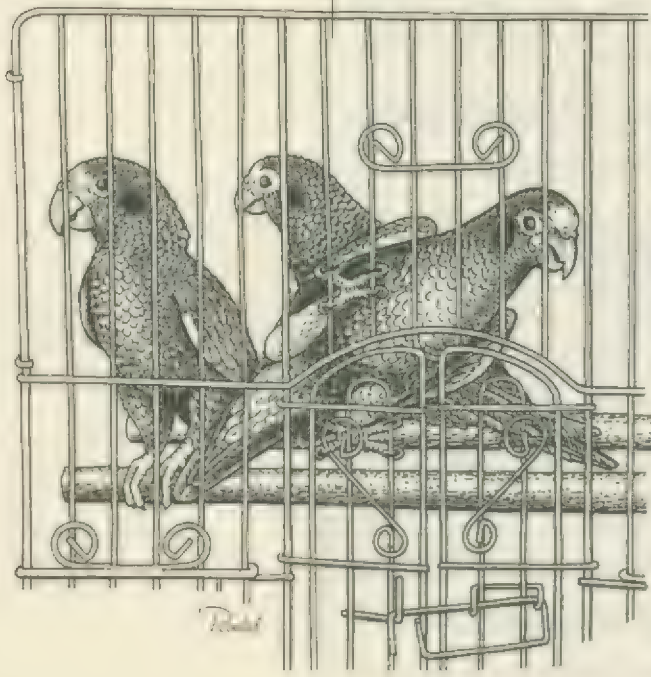
This book is relevant to anyone interested in any aspect of arctic or alpine ecology or biodiversity in the current information period. It is also an excellent source of references for further reading.

*Susan G. Aiken, Research Scientist, Canadian Museum of Nature*

## Système d'information et de gestion des échantillonages sur la biodiversité (SIGED), Description générale.

André Francoeur. 1994. Centre de données sur la biodiversité du Québec, Université du Québec à Chicoutimi, QC. 18pp.

This document presents the basic characteristics and capabilities of the system put together to supply and organize the enormous quantity of existing data, and to support future inventories of the Quebec fauna. It also summarizes the data-processing approach used to produce the relational database and discusses certain basic or epistemological aspects of the sample data. The summary is divided into five parts: Introduction; Components of the System; Characteristics of the Relational Database; and Problems Specifics to Biodiversity Perspectives. [Publisher]



Contraband red-necked parrots (*Amazona Arrausiaca*) surreptitiously photographed by the artist in the Caribbean.

## Ethics on the Ark: Zoos, animal welfare, and wildlife conservation

Edited by Bryan G. Norton, Michael Hutchins, Elizabeth F. Stevens, and Terry L. Maple. 1995. Smithsonian Institution Press, Washington, DC, USA. 330 + xxvi pp. ISBN 1-56098-515-1. US $32.50.

Are zoos relics of the Victorian era? Sources of education or entertainment? Proponents or culprits in animal welfare? Essential for research? Important for captive breeding? These questions motivate this volume, based on a conference of leading and diverse authorities held in Atlanta, Georgia in 1992.

The book opens with a brief foreword by David Ehrenfeld, an overviewing preface by Bryan Norton, and an introduction in which William Conway considers the ethical paradoxes of zoos, such as the possibility that they are a pressure on endangered species, not a solution. The next 23 chapters, each well introduced, are arranged in four sections. The following are the highlights of each section.

**1) The Future of Zoos.** Here Eugene Hargrove contrasts environmental welfare and animal welfare; David Hancocks calls for a better interpretation of nature; Tom Regan finds no moral defense for zoos among existing ethical viewpoints; and Dale Jamieson mounts an impressive critique against zoos — the tension between zoos seeking public support through entertainment while justifying themselves through preserving species.

**2) Targets of Protection** *(from genes to ecosystems).* In this section Dale Jamieson discusses how to deal with the inevitable conflicts among these targets; Robert Vrijnhoek analyzes the biology underlying units of conservation; and Bryan Norton is eloquent in his call for a pluralistic approach involving contextual compromises.

**3) Captive Breeding and Wild Populations.** This section examines the justification for captive breeding and the cost to other objectives. The costs of procurement, re-introduction, and the regulation of captive populations are portrayed: only a minority of re-introductions have been successful, and authors differ strongly on whether zoos, distinct breeding facilities, or the field are better sites for responsible action. The analysis by Robert Loftin is particularly insightful.

**4) Good Stewardship.** Here captive care and maintenance, experimentation, and public relations are explored: Maple et al. consider the balancing of these activities very reasonably, which makes the ensuing criticism of John Wuichet and Bryan Norton dour indeed; the reviews of research ethics by Hutchins et al., and of marketing by Karen Allen, bear much merit.

Although there is no index or combined list of references, there is a glossary and a very valuable appendix of consensus-searching efforts providing overviews of the key issues and questions. The book highlights controversies in a point-counterpoint style, especially the role of zoos in captive breeding. Despite the disagreements, the book manages to clarify the next steps that should be taken. Thoughtfulness and clarity characterize almost every contribution. This is an important and worthwhile book for anyone interested in animal welfare, bioethics, conservation, or zoos.

*Patrick Colgan, Book Review Editor*

## The coevolutionary process

By John N. Thompson, 1994. University of Chicago Press, 376 + xi pp. Paper ISBN 0-226-79760-0, $19.95 US.

Already well known for his 1982 *Interaction and Coevolution*, Thompson in this book provides an update on relevant data and hypotheses and introduces what he terms a geographic mosaic theory to deal with multiple species, spaces, and times. Following a preface and overview, the material is a smooth blend of observations and interpretations drawn from systematics, ecology, genetics, ethology, and physiology, and is organized into four sections. Under "The Entangled Bank," specialization and coevolution are reviewed from Darwin through the evolutionary synthesis to the present: how species and their interactions lead to these processes, their antiquity and current dynamics, the vocabulary employed to deal with them, the role of central topics such as pollination, biology and mimicry (respectively promoted by Darwin and Bates), the lengthy rift between evolutionary biology and ecology, issues such as levels of selection and optimal foraging theory that have brought them together, and especially the realization that specialization is not an evolutionary dead-end. Under "The Evolution of Specialization," specialization is examined phylogenetically, genetically, and ontogenetically: the distinction of historical and adaptive factors, the role of natural selection in evolutionary preadaptation and inertia, the complexities of phylogenetic derivation and tracking, genetics of traits ranging from rhizobial through feeding associations, and ontogenies involving host alternation by parasites, metamorphosis, and feeding. Under "Natural Selection and the Geographic Structure of Specialization," the emphasis is on parasitism as a major evolutionary force, specialist and generalist associations and their geographies, and forces shaping mutualistic specializations. Under "Specialization and Coevolution," consideration of the genetics of coevolution leads to the geographic mosaic theory drawing on Wright's earlier work and expressed through a set of specific hypotheses regarding dynamics over space and time. Coevolution is discussed in terms of its diversifying role in radiating webs of associations, and outcomes from asymmetric specializations.

Much literature on many complex issues is examined in this book, and appropriately there is particular attention to arthropod-plant interactions and to the historical bases of empirical and theoretical approaches. Thompson usefully looks ahead to analysis within a hierarchy of spatial scales and to promising avenues for research. Illustrations are sparse but effective. Readers of this magazine will find the epilogue on specialization, coevolution, and conservation especially germane, with its emphases on loss of biodiversity in terms of interactions as much as species, and on the importance of geographic issues. Thompson argues that "the intellectual and economic value of extreme specialists, highly evolved interactions, and the geographic structure of interactions have not been part of the usual lexicon of arguments about the need for conservation and the preservation of biodiversity." This book is important reading for everyone seeking to understand the processes underlying, or to conserve, the profusion of our natural world.

*Patrick Colgan, Book Review Editor*

## The ecology of fire

By Robert J. Whelan. 1995. Cambridge University Press, New York., pp. 346. ISBN 0-521-33814-X (paperback). US $27.95.

This book examines the changes wrought by fires, with reference to general ecological theory. The impact of fires on individual organisms, populations, and communities are examined separately, and emphasis is placed on the importance of fire regime. Each chapter includes a listing of "outstanding questions" that identify gaps in current knowledge. The book ends by summarizing the major aspects of ecology that are of particular relevance to management of fires — both protection against wildfires and the deliberate use of fire. [Publisher]

## An overview of the world's Ramsar sites

Edited by Scott Frazier. 1996. Wetlands International, Slimbridge, Gloucester, GL2 7BX, UK. 58 pages, 47 col plates, 46 col figs. £20 UK

Concise and well-illustrated, this book is aimed at all professionals with an actual or potential interest in the Ramsar Convention. It is intended to raise awareness of the Convention as a whole, of the scope and effectiveness of the network of Listed Ramsar Sites, and of the Database of Listed Sites as a tool for implementation of the Convention. [Publisher]

## A common fate: Endangered salmon and the people of the Pacific Northwest

By Joseph Cone. 1995. Henry Holt & Co., Inc., New York. Hardcover, 340 pp. ISBN 0-8050-2388-7. US $25.00.

Drawing on abundant data from natural science, Pacific coast culture, and a long association with key individuals on all sides of the issue, Joseph Cone employs a clear narrative voice to tell the human and natural history of an environmental crisis in its final chapter. He reconstructs the factors, such as overfishing, dam building and habitat destruction, that have caused the rapid depletion of the salmon stocks, and examines the parallel growth in concern over the problem, what is being done, and the complex ecologic, economic and social issues surrounding this crisis. [Condensed from Publisher]

## Ecological versatility and community ecology

By Ralph C. MacNally. 1995. Cambridge University Press. Hardcover, 435 pp. ISBN 0-521-40553-X. US $69.95.

This book is about specialization and generalization in the use of resources and habitats. The author uses a broad ecological perspective to address three main questions. How do ecologists study variation in resource and habitat use, and what do we know from these studies? How well does existing theory account for observations, and what are the common threads between disciplines? Finally, what is the relationship between resource and habitat use? This book attempts to provide a comprehensive analysis of ecological versability. [Condensed from Publisher]

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## Some recent titles of note . . .

**Biological implications of global change: Northern perspectives.** Edited by Rick Riewe and Jill Oakes. 1995. Canadian Circumpolar Institute, University of Alberta, Edmonton, Alberta T6G 2E2. Hardcover, ISBN 0-919058-89-2. CDN $20.00.

**The Canadian renewable energy guide.** Edited by Duncan Noble and Robert Swartman. 1995. General Store Publishing House, Burnstown, Ontario. Softcover, 235 pp. ISBN 0-9680059-0-X. CND $24.95.

**Geographic information systems for geologists: Modelling with GIS.** By Graeme Bonham-Carter. 1995. Elsevier Science, Inc., NY. 415 pp. Cloth, ISBN 0-08-041867-8. US $110.00.

**Methods of environmental impact assessment.** Edited by Peter Morris and Riki Therivel. 1995. UBC Press, Vancouver. 400 pp. Paper. ISBN 0-7748-0526-9. $CDN 34.95.

**Serengeti II: Dynamics, management, and conservation of an ecosystem.** Edited by A.R.E. Sinclair and M. Norton-Griffths. 1995. The University of Chicago Press, Chicago, IL. 665 pp. Paper, ISBN 0-226-76023-4. US $32.95.

**Habitat conservation planning: Endangered species & urban growth.** By Timothy Beatley. 1994. University of Texas Press. 272 pp. Paper, ISBN 0-292-70806-8. US$ 17.95.

**Biodiversity and pest management in agro-ecosystems.** By Miguel A. Altieri. 1994. The Haworth Press, Inc., 10 Alice St., Binghamton NY. Hardcover. 186 pp. ISBN 1-56022-037-6. US $39.95.

**Mapping the diversity of nature.** By Ronald I. Miller ed. 1994. Chapman & Hall. Cloth ISBN 0-412-45510-2. US$ 59.95.

**Deeper shade of green: The rise of blue-collar & minority environmentalism in America.** By Jim Schwab. 1994. Sierra Club Books. 480 pp. Paper, ISBN 0-87156-462-9. US$ 30.00.

**Biodiversity challenge: An agenda for conservation in the UK.** By The Royal Society for the Protection of Birds, The Lodge, Sandy Beds. SG19 2DL, UK. 285pp. ISBN 0-903138-80-8.

**Biology and conservation of the Monarch butterfly.** Edited by Stephen B. Malcolm and Myron P. Zalucki. 1993. Natural History Museum of Los Angeles County, Los Angeles, CA 90007. Hardcover, 419 pp. ISBN 0079-0943. US $90.00.

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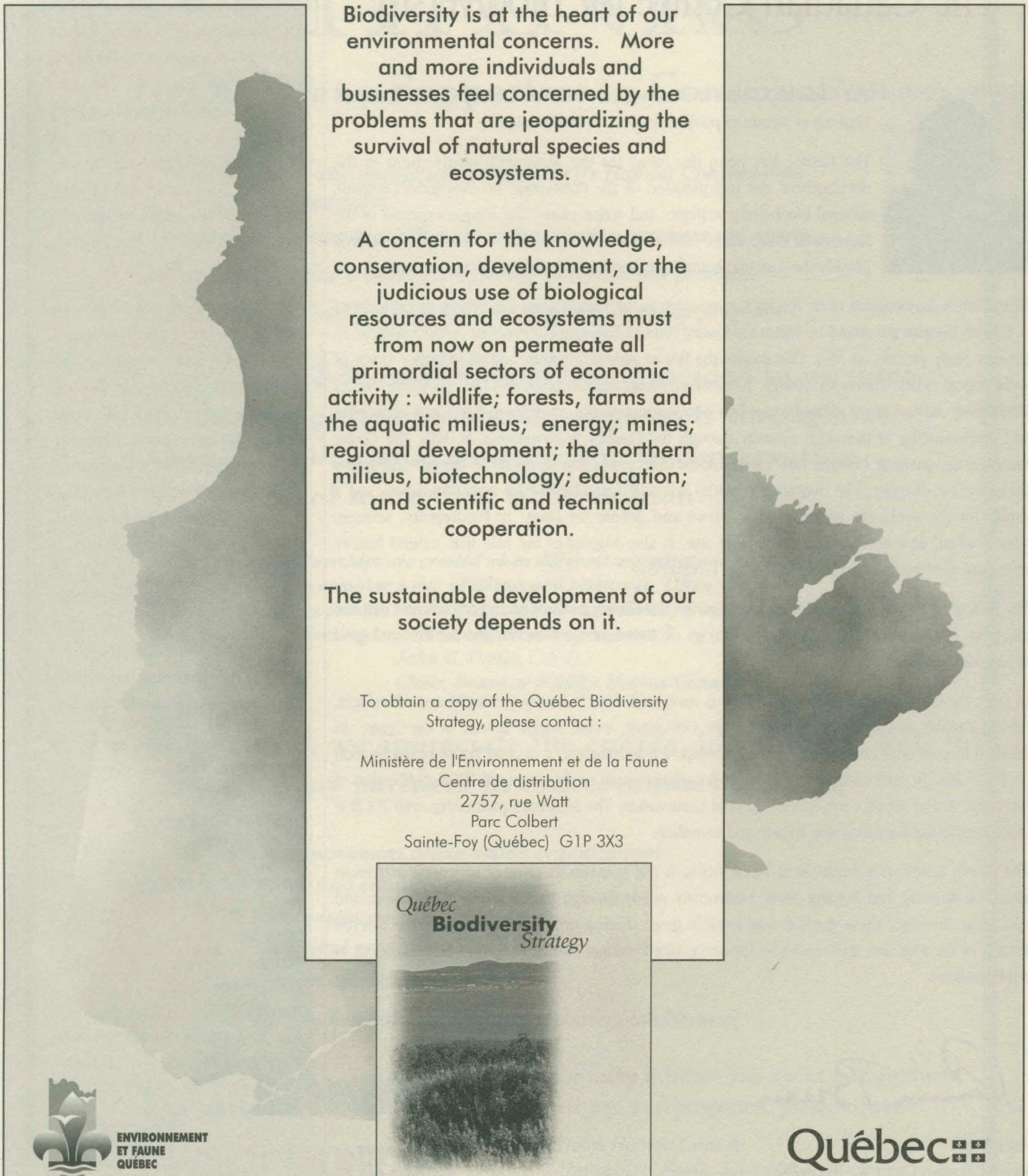

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# The Canadian Centre for Biodiversity

The Canadian Centre for Biodiversity was founded in 1991 by the Canadian Museum of Nature to position its work in biodiversity.

The Centre has been the focus for the Museum's involvement in the development and interpretation of the Convention on Biological Diversity, national biodiversity strategies and action plans. The unique expertise of the Museum in comparative collection-based systematics and taxonomic research provide the scientific knowledge fundamental to the work of the Centre.

The Centre's development of an innovative approach to the identification and survey of native biota in Canada became the model by which the United Nations Environment Program (UNEP) initiated its Country Study process. In 1991, Canada was the first to attempt a holistic and all inclusive survey of its biological riches. Robert McFetridge, Biodiversity Programme Director, and Don McAllister, Senior Biodiversity Advisor, were at the frontier of a new era in assisting countries to develop a knowledge and understanding of biological diversity through the Country Study process. In 1991, the Centre launched the quarterly bulletin, now called *Global biodiversity*, that serves as an international forum on biological diversity. The magazine provides scientific information to a broad audience, and a forum for the exchange of knowledge, views and debate on issues of biodiversity, science, conservation, and ecologically sustainable use. It also highlights the role that natural history museums, systematics and collections play in biodiversity.

The Biological Survey of Canada is a module within the Centre. It develops and co-ordinates national initiatives in systematic and faunistic entomology on behalf of the Museum and the Entomological Society of Canada.

In 1991, the Canadian Committee for IUCN was revitalised. Alan R. Emery, former Museum President, offered support to set up a Secretariat for the Committee, which is now housed at the Centre. In addition to providing assistance to its membership, the Secretariat is a clearing house of information on IUCN and its commissions. It also facilitates projects such as the proposed IUCN publication of the Crane Action Plan for the Species Survival Commission. The Museum's partnership with IUCN is made real by the Centre's active linkage and animation.

The Centre is now at a threshold in its evolution. It will maintain its goals of increasing awareness about biodiversity and helping serve biodiversity needs through partnerships, cooperation, and education. To foster these goals it was recently given more a prominent position in the Science Branch of the Museum, and reports to Executive Vice-President Patrick Colgan to facilitate input in public policies.

Anne Breau

Anne Breau
Head, Canadian Centre for Biodiversity

## A few words about the Canadian Museum of Nature

The Canadian Museum of Nature (CMN) has its origins in the Geological Survey of Canada. Over 150 years later, the CMN has some 8 million specimens in its collection, which still represents only half the known species in this country, and an active team of scientists, collection managers, education specialists, and business experts.

The CMN's mandate is to increase knowledge and understanding of, appreciation and respect for, and interest in the natural world. This role has never been more crucial, as the demand for environmental harmony between the world's burgeoning human population and nature reaches a critical point. Scientifically, the Museum is developing research in three main areas: the Arctic in Peril, the Crisis in Biodiversity, and Origins of Modern Problems. For more information about the Museum's activities, please contact Karen Hahn, Corporate Communications at (613) 990-6273.

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> ***Chair, Board of Wildlife Habitat Canada***

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ISSN 1195-3101 (English Edition) ISSN 1195-311X (édition française)

The focus of one conservation program that the IUCN is involved in is the ron palm, *Borassus aethiopum*. See page 4 for more details.

***The mission of the World Conservation Union — IUCN — is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.***

Canadian Museum of NATURE
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GLOBAL BIODIVERSITY Volume 6, Number 2, Fall 1996